DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE
WETLAND MANAGEMENT PROGRAM
ST. BERNARD PARISH, LOUISIANA

A PROGRAM TO ARREST WETLAND
DETERIORATION AND ENHANCE FISH,
WILDLIFE AND RECREATIONAL RESOURCES

PREPARED FOR

ST. BERNARD PARISH POLICE JURY
TO FULFILL REQUIREMENTS OF THE
OFFICE OF COASTAL ZONE MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
DEPARTMENT OF COMMERCE

APRIL, 1979

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by

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SECTION I: GENERAL PROJECT DESCRIPTION

A. SITE

St. Bernard Parish is located in southeast Louisiana, entirely within the Louisiana coastal zone. It is bounded on the north by Orleans Parish and the Mississippi Sound, on the south and west by Plaquemines Parish, and on the east by the Gulf of Mexico. St. Bernard Parish is approximately 3,626 sq km (1,400 sq mi), of which 79% is water, 19% is wetland, and 2% is urban and agricultural land. Figure 1-1 shows the study area and parish boundaries.

St. Bernard Parish is rapidly changing in both its physical and cultural base. Its dynamic physical landscape is constantly being modified by natural forces such as erosion, subsidence, and hurricanes; and by human development such as canal building, drainage projects, and urbanization. The cultural setting is evolving from an agricultural rural framework to a residential sprawl suburb of New Orleans with an industrial complex of its own along the Mississippi River. The setting of the parish offers opportunities for urban growth within the constraints of the environmental system.

B. RELATIONSHIP OF THE PROPOSED ACTION TO THE TOTAL PROJECT

The proposed action is the management through structural means of selected wetland areas in St. Bernard Parish. The purpose of this management program is to prolong existence of the wetlands as a productive and valuable public resource. These wetlands perform a number of important functions. Through food chain production and by providing general

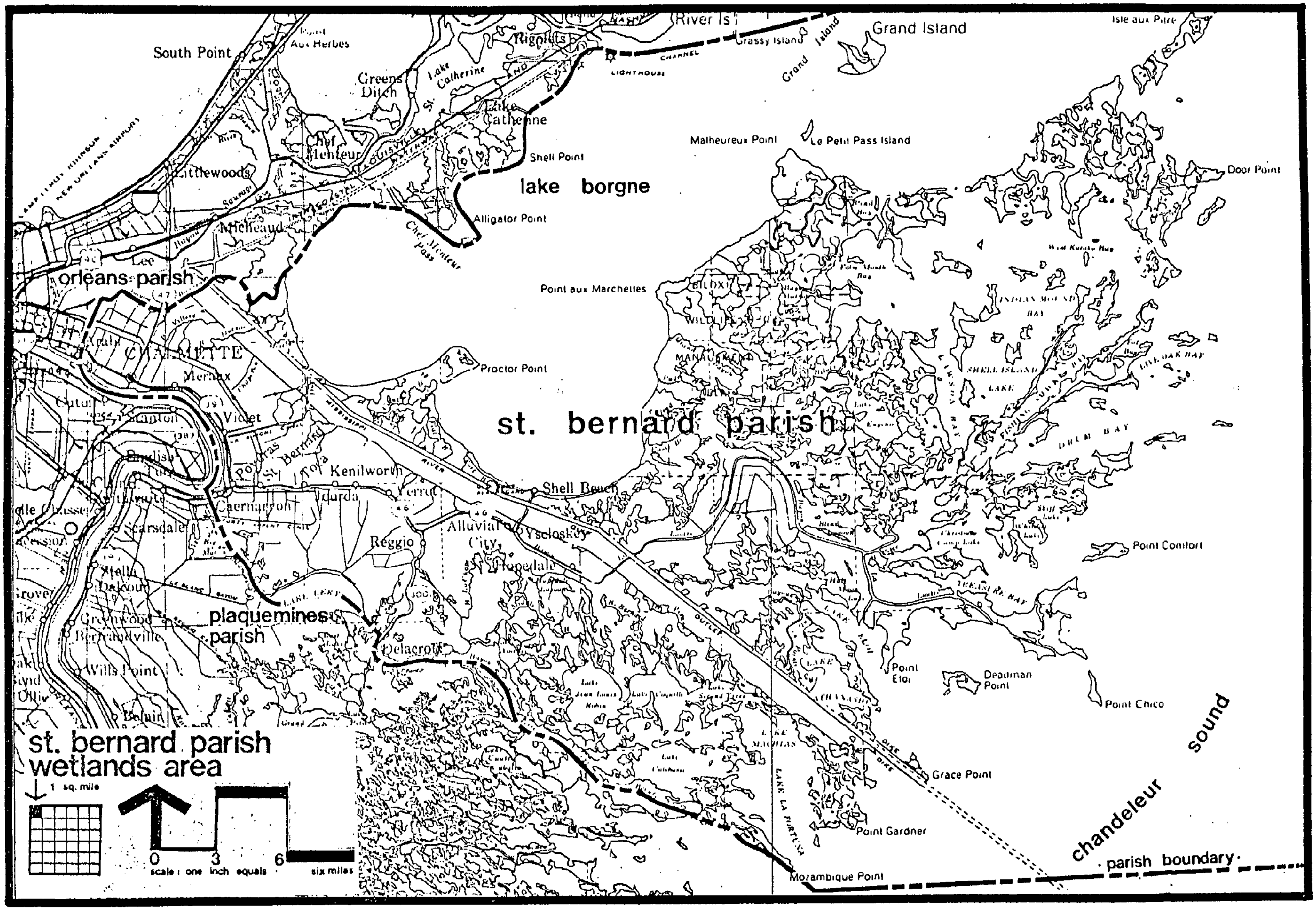

Figure 1-1. Study area, St. Bernard Parish, Louisiana.

habitat and rearing areas they support Gulf Coast fisheries and local trapping industry. They partially shield the urban area and the protective levee systems of St. Bernard Parish from wave erosion and hurricane storm surge, and provide water treatment of runoff from the urbanized natural levee ridges. Accessibility of the area and proximity to the city of New Orleans renders the area a prime recreation resource.

To ameliorate current processes that gradually diminish the extent and quality of wetland area, and thereby the performance of its various functions, structural measures are proposed. Specifically, these measures are intended to combat erosion, subsidence, and saltwater intrusion, and to control water levels and water quality.

1. Concept of Management Units

To set goals and priorities for management of the parish wetlands, there is a need to identify areas which have certain common physical or cultural characteristics. These characteristics include the type of surface environment and subsurface conditions which set one area apart from other areas. Various areas are identified as units of common physiographic conditions and habitat defined by natural or cultural system boundaries. These units may be considered individually as entities and in their relationship to each other. Goals can thus be developed in relation to physical and cultural characteristics, and management procedures can be set for the units. The environmental management units affected by the proposed action are shown in Figure 1-2. Goals, potential solutions, and the management units to which they apply are discussed in this section under "Operation and Maintenance."

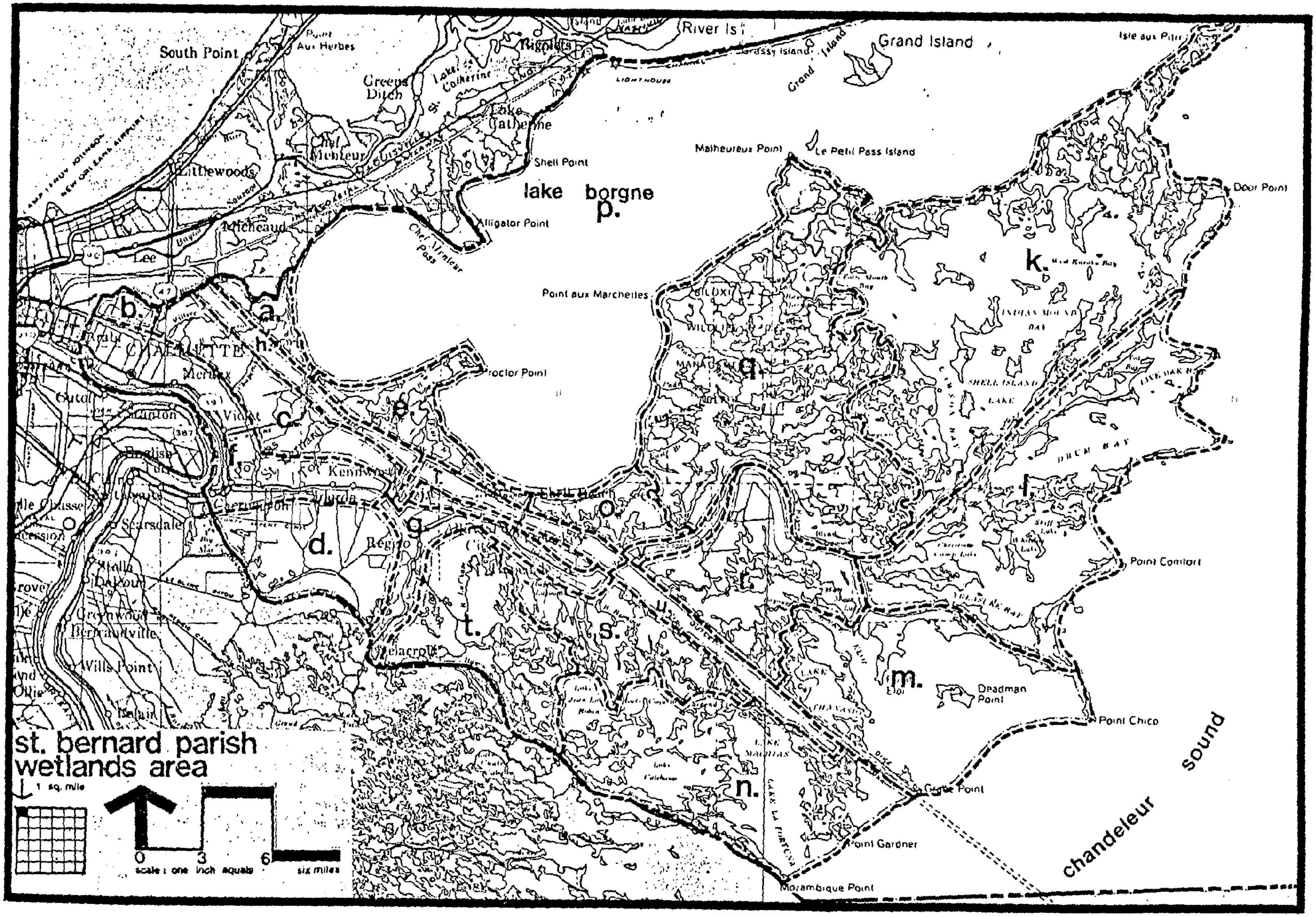

Figure 1-2. Environmental management units of the St. Bernard Parish wetlands area.

C. OPERATION AND MAINTENANCE

Setting goals and priorities for the management units; and planning, designing, constructing, operating, and maintaining the appropriate structural measures would be the responsibility of the people of St. Bernard Parish, the St. Bernard Planning Commission, and ultimately the St. Bernard Police Jury.

Overall parish management goals involve social and economical considerations which are finely knit into environmental issues and problems. St. Bernard Parish has as one of its planning goals the management of its wetlands to achieve the proper balance between conservation and development by encouraging reasonable and suitable uses which will result in economic and social benefits. A successful program for management of St. Bernard Parish wetlands has to be a part of an overall parish management program which integrates land development and protection of land and water resources. Goals for wetland management must emphasize the compatibility of desirable functions for both the wetlands and the highly developed areas. Development of the fastlands must be managed so that normal wetland functions are not impaired or destroyed. Inherent within this concept is the need for consideration of the interface, or buffer zone, and the wetlands. The narrower this interface, the greater is the need to achieve compatibility between goals and management programs for the fastlands and the wetlands.

The idea of compartmentalizing the landscape into fastlands, interface, and wetlands for management purposes is not new. Odum (1969) offers a solution to the planning dilemma by devising a multiuse strategy in which the landscape is compartmentalized "so as to simultaneously maintain highly productive and predominantly protective types as separate units subject to different management strategies." He suggests compartmentalizing the landscape into four systems: productive, protective, compromise, and urban-industrial.

The productive system should be managed to maximize its most suitable outputs such as fisheries and agricultural products, timber, fur, hides, crayfish, and minerals. The primary goal of a protective system is to recycle materials and nutrients within the system, to isolate itself from outside disturbances, and to expand all its energy to maintain itself rather that to produce an abundance of exploitable, surplus products. In a compromise system, productive and protective management goals should be combined in order to obtain an adequate yield or harvest while protecting the area's natural renewable productive capabilities. The urban-industrial system is a creation of man, and its main purpose is to provide humans with a safe, functional habitat.

The management system can be applied to the landscape and land use suitabilities of St. Bernard Parish (Figure 1-3). The fastlands constitute the urban-industrial system, the interface functions as a compromise system, and the wetlands comprise both the protective and productive systems. In order to maximize the functions of each of these systems or areas (fastlands, interface, and wetlands) in view of past and present human manipulations, it will be necessary to employ structural and non-structural measures to fulfill management needs (Table 1-1).

1. Fastland Management Needs

The fastland comprises the highly urbanized higher grounds along the natural levees and those areas which are protected by the hurricane and

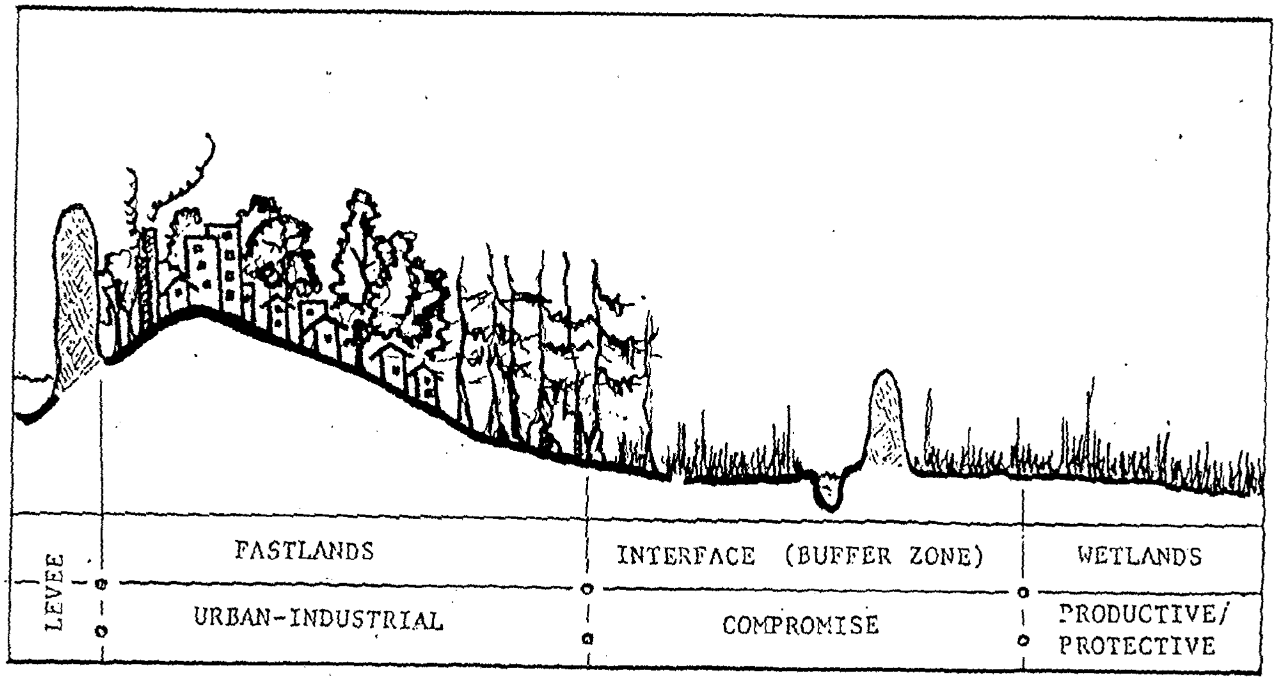

Figure 1-3 Odum's compartmentalization of the environment in relation to St. Bernard Parish environments.

Table 1-1. List of Management Needs by Environments

Fastland Management Needs

Land Use (types and densities)

Flood Protection

Efficient Drainage

Proper Waste Disposal

Interface Management Needs

Land Use (types and densities)

Proper Drainage

Control of Environment

Wetland Management Needs

Wetland Use (types)

Maintenance and Enhancement of Original Habitat Distribution

Maintenance and Enhancement of Original Habitat Quality

Water Quality Maintenance

Normal Water Movement

Erosion Prevention

Compatible Resource Development

flood protection levees (See Figure 1-2, Management Units x, f, g)(CEI, 1976). This urban-industrial system is primarily a man-made system which functions at man's discretion. In order for it to function properly, it has to rely heavily on energy and materials coming from outside the system. Understanding and perfecting the functioning of this system will create a better human habitat and prevent the degradation of surrounding environments as a result of urban-industrial development activities.

The fastland management program must focus on achieving optimum land development through proper management techniques. Major management concerns must include desirable land use, hurricane and flood protection, efficient surface drainage, adequate waste disposal, and development and maintenance of support facilities.

2. Interface Management Needs

The overall parish management program should work toward the creation and maintenance of an interface between fastland and wetland areas. When considering the combined needs to preserve valuable open space within developable areas, to maintain a protective buffer zone between fastlands and wetlands, and to provide adequate drainage within leveed areas; a desirable goal would be the establishment of a non-impounded forest belt surrounding the developed areas inside the artificial levees (See Figure 1-2, portions of Management Units c, d, l, s). This interface could be managed as a compromise system where the functions of productive and protective systems can be combined.

An immediate management goal for this area is revitalization of these forests. This can be done by repairing the flood gates and pumping excess water out of the impoundments. Some direct benefits of reestablishment of fresh water swamps will be the creation of a wildlife and recreational resource base and an environment for partial treatment of surface runoff from the more elevated portions of the fastlands. Construction and proper utilization of this type of interface zone would enhance the beneficial functions of wetlands and fastlands by minimizing direct impacts of one upon the other, thereby lessening environmental stress within each system.

3. Wetland Management Needs

a) Wetland and water uses

The wetland management program must focus on the physically protective and biologically productive aspects of the environment. In St. Bernard Parish this will require maintenance and selective reestablishment of large expanses of wetlands. All wetland functions, including the primary productive and protective functions as well as the secondary support functions, are directly related to a viable wetland.

To achieve its general goal, the wetland management program must identify and implement long-term, parish-wide measures, as well as short-term, localized measures consistent with the overall management goal but applicable to problem areas within individual management units (CEI, 1976). The short-term measures can be implemented on a unit-by-unit basis, and priorities can be set for specific areas and an established time frame.

The main goal for wetlands management on a parish-wide basis includes at least four principal objectives:

1) maintenance and restoration of physical integrity,

2) maintenance and restoration of habitat diversity,

3) maintenance and restoration of the natural hydrologic regime, and

4) maintenance and restoration of desirable water qualtiy.

These goals can be accomplished through 1) proper water and wetland utilization, 2) improvement of habitat quality and proper diversity distribution, 3) reestablishment and enhancement of wetland vegetation, 4) improvement of water quality and reestablishment and maintenance of natural circulation patterns, 5) deterring of natural and man-accelerated erosional processes, and 6) appropriate exploitation of wetland, aquatic, and estuarine resources.

The control and regulation of certain types of common wetland uses such as navigation, energy resource development, mineral exploration and production, and expansion of fastlands into wetlands is needed in order to prevent further wetland deterioration. It is also needed to mitigate to the greatest extent possible the incompatibility of certain uses with the achievement of the stated goals for wetlands.

SECTION II: PURPOSE OF PROJECT

A. AREAS AND COMMUNITIES AFFECTED

The wetland management program will directly and indirectly affect all of St. Bernard Parish, approximately 3,626 sq km (1,400 sq mi). Its indirect benefits could affect several eastern coastal Louisiana parishes, including Orleans, Jefferson, and Plaquemine Parishes. Some of the beneficial impacts, such as enhancement of fisheries production, could be more than regional in nature and benefit the nation as a whole.

The communities to benefit from the wetland management program are primarily those within the urban developed and semi-developed areas of St. Bernard Parish. These include the fastlands and highland ridges along the natural levees of Bayou La Loutre and Bayou Terre-Aux-Boeufs. The principal towns within these areas are: Chalmette, Violet, Yscloskey, Reggio, and Delacroix.

B. NEED FOR PROJECT

Coastal human activities, especially those related to energy and energy-related facilities, are precipitating coastal wetlands deterioration in St. Bernard Parish. Their associated adverse impacts are threatening economic growth, and the safety and livelihood of the parish residents. The values and the functions of the wetland areas of the parish are rapidly being lost to subsidence, saltwater intrusion, erosion, and other related problems. This is affecting the natural resources of the area, and in turn many of the basic economic resources of the parish.

The proposed wetland management program has been designed in the interest of environmental protection, enhancement of human use, and promotion and maintenance of natural resources within the parish.

C. ECONOMIC STATUS

Past baseline and resource studies of the parish wetland resources have set the stage for identification of resources, problems, and opportunities; and for the implementation of a number of measures that address the initial problems within the framework of the present system. The next step on the wetland management program is to focus in detail on a management unit by management unit basis, identifying those which should have first priority in terms of critical problem areas, and selecting appropriate land uses and corrective structural measures. Already some structural management measures are being planned and constructed by the Parish Police Jury as part of an overall wetland management program plan. The Violet siphon, designed to introduce fresh water from the Mississippi River into some of the more critical parish wetland areas via the Lake Borgne Canal at Violet, is such a project. This project is funded by a grant from the Coastal Energy Impact Program, Office of Coastal Zone Management, NOAA, Department of Commerce. Approximately $1,118,662.00 will be required to further develop a detailed management program implementation study and to purchase the necessary equipment to implement the selected structural measures.

SECTION III: PROJECT ALTERNATIVES

A. NO BUILD ALTERNATIVE

1. General Description of the Alternative

This alternative would involve the decision of not developing and implementing a wetland management program in St. Bernard Parish. Without the proposed project, the future environmental conditions of the project area would be related to the deteriorating process actually taking place in the study area. Marsh erosion, saltwater intrusion, and subsidence are gradually changing the original character of freshwater swamps and marshes that occupy the majority of the study area's extension.

2. Adverse Impacts of the No Build Alternative

a) Shoreline erosion along lake margins

The lakes in St. Bernard are shallow water bodies that can be rapidly changed from placid water to a high energy condition by local winds and storm patterns. The shorelines of these lakes are composed of soft mucks and organic soils with some areas of low shell beach ridges. The lake edge is highly susceptible to erosion and the lakes are continually being enlarged by an erosion process. In critical areas where the lake edge is near urban areas, it would be desirable to retard this process.

b) Erosion along small waterways

Small commercial and pleasure boats use the large number of channels and waterways available throughout the marshland area. Some of these are named bayous and some are dredged and maintained; the vast majority are tidal marsh channels. Those that are most heavily used are subject to erosion by boat wake because of the soft sediments that make up their edges.

(c Erosion along pipelines

After a pipeline is constructed, an open channel is frequently left. The intersections of the pipeline with other water bodies are supposed to be blocked with shell fill dams. Slumping of pipeline canal walls and subsidence or erosion of the dams leads to widening of the canal. This is particularly prevalent when water circulation takes place between the canal and other water bodies because the shell dam is too low or is destroyed.

d) Mississippi River Gulf Outlet (MRGO) erosion

Extensive erosion is taking place along the MRGO because of wave and large boat wake attack. This erosion is particularly serious on the east bank of the canal because there is only an easily eroded natural marsh edge to withstand the forces of wave action and rapid return flow of water from the marsh into the MRGO. This condition has increased the depth and width of bayous leading into the MRGO; islands of marsh have been entirely lost, and embayments have been opened up along the canal edge.

e) Saltwater intrusion

Since construction of the MRGO, and during storms, the salinity levels in areas that were once fresh or intermediate marsh have increased. The increased salinity has destroyed or changed habitat diversity and balance within the parish. It is considered a desirable management practice to reestablish habitat diversity and maintain some marsh areas in a fresher condition than is possible at present.

f) Water level control

Water levels in marsh and swamp areas play a critical role in their existence. Extensive long-term flooding can lead to vegetation kills and opening up of marsh or swamp to a pond environment. The building of pipeline canals, spoil banks, channels, and other such features causes changes in water flow patterns and, therefore, changes in water levels which can be critical in relation to vegetation.

g) Water quality control

Ponding, restriction of water circulation, and introduction of foreign matter (such as sewage) can have an adverse effect upon water quality. Normal decomposition of plant material and organic sediments, algae blooms, and other such processes can also lead to stagnation and lowering of water quality for fish and other aquatic life.

h) Habitat destruction

Habitat loss in St. Bernard Parish is, to a great extent, a result of natural processes of delta front retreat, erosion, and subsidence. Subsidence is particularly critical where marsh aggradation cannot keep pace with sinking because of lack of river sediment and mineral nutrients brought in by flood waters. Erosion changes in hydrologic patterns and dredging and filling have an influence as well. The construction of the MRGO and its spoil bank has adversely affected large areas of habitat through these activities.

i) Gulf front erosion

The area of the parish most open to land loss is along the Gulf front. An examination of a map of the parish will make evident the fact that the nearer the land is to the Gulf, the greater is the ratio of water area to land area. Marine forces are going to continue to erode the coastline and move it westward and northward toward the developed parts of the parish. Selected areas along this front need reinforcement to reduce erosional rates.

In summary, opening up of present marshes, that is an increase in the water/land ratio, is undesirable for a number of reasons. Not only does it represent a direct loss of highly productive marsh habitat, but it also accelerates further losses through a number of processes; the most important of which are wave erosion, tidal scour, and saltwater intrusion. As marsh ponds increase in size, the increased water surface area provides for a greater wave fetch length which results in increased wave heights and shoreline erosion. The process thus is self-reinforcing; soon several marsh ponds merge into a bay. An increase in water/land ratio also enlarges the tidal storage volume so that greater volumes of water are exchanged during each tidal cycle. This leads frequently to increased erosion of the tidal channel by currents resulting in further marsh loss and facilitating saltwater intrusion. An increase in the water/land ratio diminishes the ability of the wetlands to serve as a fresh water storage area. Fresh water retention is diminished by both increased hydraulic efficiency and by the increased tidal exchange.

3. Beneficial Impact of the No Build Alternative

The fact that the parish is in a regressing, deteriorating, and subsiding coastal area is significant. The riverine processes that led to building the parish outward and upward have been taken away, and unless riverine processes and materials can be approximated, most actions taken for protection will be only short-term holding actions to retard the inevitable march of events. Therefore, programs need to concentrate funds and resources on those units that are most critical to the human welfare in the parish. Thus, there would not be any direct beneficial impacts related to the no build alternative of this project.

4. Decision on this Alternative

Because of the adverse implications of not developmenting and implementing a wetland management program for St. Bernard Parish, the no build alternative was rejected.

B. STRUCTURAL ALTERNATIVES

There are no structural alternatives to the wetland management program. There are, however, several structural measures available as possible alternative measures within the management program itself. These will be discussed in Section IV of this report.

C. NON-STRUCTURAL ALTERNATIVES

There are no non-structural alternatives to the wetland management program. There are, however, several non-structural measures available as possible alternative measures within the management program itself. These will be discussed in Section IV of this report.

SECTION IV: PROJECT DESIGN

A management program is not a finite action or a rigid plan. It is a flexible and continuous process that allows for growth and change to meet new conditions and new needs. It deals with the realities of the relationship between the natural environment, people, structures, and circulation systems; time; density or intensity of use; and desirability and feasibility of action. From a comprehensive base, structural and non-structural actions will be initiated to accomplish specific goals.

Components of the wetland management program include:

1) Engineering Design (Planning and Design Component)

   Detailed studies of management units to define specific values and problems. Determination of appropriate management measures to maximize opportunities and solve the specific problems encountered by means of non-structural and structural measures.

2) Environmental Protection Features (Implementation Component)

   The carrying out of steps necessary to resolve problems, and monitoring results with regard to non-structural measures (regulation, ordinances, etc.) and structural measures (weirs, drainage canals, etc.).

A. ENGINEERING DESIGN (Planning and Design Component)

Planning includes 1) setting priorities for management implementation for various management units, 2) development of plans according to set goals for potential resource and environmental management for those units, and 3) taking the necessary actions to carry out management measures which will accomplish the desired results.

Setting priorities for management implementation is essential. Those management units of greatest need and value to the parish should be considered first. Those units which offer first-line protection from hurricane surge to parish-inhabited areas seem to be of highest priority for management. These include management units a, b, c, e, f, i, and o (See Figure 1-2). Nevertheless, specific problems on other units may require immediate attention, and therefore would have to be considered high priority.

Plans for the specific management units should reflect the overall management program goals as well as address the particular management needs of the unit. For example, it might be that a particular plan for a specific unit might be economically feasible, but not environmentally desirable; thus the plan would be rejected to favor another that would be in accordance with all conditions.

Detailed studies of specific areas and management units are necessary to improve the data for decision making. Presently certain short-term measures are being taken to combat apparent problems, but it is also essential to continue with long-term comprehensive planning leading to specific projects.

Past studies have provided baseline data. It is necessary now to develop additional specific information to help identify problem areas and to establish priorities. Only after this determination is it possible to address the problems appropriately and select the required management measures.

Once a management unit has been identified as having highest priority in terms of management needs, a detailed baseline study should be conducted. The baseline data should provide a complete analysis, including geologic setting, soil characteristics, hydrological measurements, vegetation and wildlife information, present land uses or activities which take place in that particular unit, existing structures, and principal resources - including historic or archeologic resources. Interpretation of this data will be necessary to identify specific water and wetland management problems present in the management unit.

The next step in the planning and design component is to set goals for the unit under consideration and to propose specific controls to achieve these goals in terms of non-structural and structural measures.

1. Non-structural and Structural Measures

Achievement of stated goals can be implemented through different techniques based on their nature and objective. Certain goals require administrative action on policy statement (non-structural measures), while others require physical action (structural measures), or both.

An integral part of a management program is the consideration of non-structural and structural measures to achieve the management goals. Depending upon the area to which these measures are applied and the planning time frame, both short-term and long-term (duration of the effect) actions are to be considered. Generally, those measures which help to reestablish riverine functions of water dispersal and sediment deposition can be considered more long-term actions than fixed structural measures.

a) Potential non-structural measures

Several non-structural measures are available to the parish government to reach management goals. The following is a list of possible alternative measures:

1) Acquire land - land is acquired for the greatest control over certain land area uses.

2) Transfer of development rights - concessions are granted to the owner for relinquishing certain ownership "rights" to the parish.

3) Regulations - local guidelines may be designed to control and impose restrictions to certain development actions and their impacts.

4) Permits - a good system for project review and maintaining control in critical areas.

5) Guidelines and technical assistance - develop guidelines and provide technical assistance which will benefit both the parish and the land owner.

6) Mitigation - an adverse effect of an unavoidable action is balanced by requiring compensation for the damage done.

7) Moratorium - a temporary or short-term measure to gain time to study a problem further and to find alternatives for its solution.

b) Potential structural measures

Structural measures to fulfill management needs involve action to restore an environment's natural processes and functions. Their specific placement, size, and design will be determined according to the specific problem in need of a management solution (Figure 4-1). Several structural measures that may be used are discussed below:

1) Siphons - The introduction of fresh water from a fresh water source, such as the Mississippi River, into wetland areas. Its main purpose is to combat saltwater intrusion by maintaining the natural salinity gradient ranging from saline to brackish to fresh water environments. In turn, vegetation would be rejuvenated, benefiting from detritus input and controlled flood conditions.

2) Weirs and dams - access channels and streams can be used to maintain normal water levels in wetlands, control flow of drainage, and control saltwater intrusion. Vegetation and wetlands habitat

STRUCTURAL MEASURES / MANAGEMENT NEEDS	FASTLANDS							INTERFACE										WETLANDS									
	LAND USE CONTROL	HURRICANE AND FLOOD PROTECTION	EFFICIENT DRAINAGE	PROPER WASTE DISPOSAL	SUPPORTING FACILITIES			LAND USE CONTROL	PROPER DRAINAGE	CONTROL STORM RUNOFF AND POLLUTION	CONTROL NON-POINT POLLUTION SOURCES	PROVIDE OPEN SPACE	PROVIDE RECREATION AND PUBLIC AREAS	REJUVENATE WETLAND FORESTS	HALT SALT WATER INTRUSION	PRESERVE NATURAL ENVIRONMENT	HURRICANE AND FLOOD PROTECTION	WETLAND HABITAT RESTORATION	WATER QUALITY CONTROL	WATER LEVEL AND CIRCULATION CONTROL	SHORELINE EROSION CONTROL	CONTROL OF EROSION ALONG WATERWAYS	CONTROL OF EROSION ALONG CANALS	CONTROL SALT WATER INTRUSION	SUBSIDENCE	MARSH BUILDING	MARSH STABILIZATION
SIPHONS																			●					●			
WEIRS AND DAMS															●			●		●				●			
CREATIVE USE OF SPOIL																						●	●			●	●
INTRODUCTION OF SEDIMENT																		●							●	●	●
HYDRAULIC FILLING TO MSL														●				●							●	●	●
FIXED STRUCTURES															●			●	●	●				●			
VARIABLE STRUCTURES									●					●	●			●	●	●				●			
LEVEES	●	●										●	●				●										
FLOOD GATES	●	●	●							●						●	●										
TREATMENT OF SURFACE RUNOFF			●		●					●	●			●		●			●								
ARTIFICIAL BARRIER ISLANDS																					●						●
WATER DIVERSION STRUCTURE																		●	●	●				●	●	●	●
WASTE TREATMENT				●	●					●	●			●				●	●								
DRAINAGE CANAL	●	●	●		●				●	●				●	●		●	●									
PUMPS	●	●	●		●				●					●			●										

Figure 4-1. Environments, management needs, and structural measures.

can thus be improved. In the past, this technique has been successfully used on a small scale by trappers in Louisiana and in St. Bernard wetland areas to improve the fur mammal habitat.

3) Creative use of spoil - spoil generated from necessary dredging can sometimes be used effectively to reduce erosion along waterways. Spoil can be disposed of in marsh areas that are deteriorating to revive them, or simply to establish new marshes where needed.

4) Introduction of sediment - the introduction of sediment-laden waters has as its main objective the direction of river waters and sediment into deteriorating wetland areas. The desired effect would be the build up of new marsh or swamp areas as a result of sediment deposition.

5) Hydraulic filling to MSL - in areas where ponding is occurring and marsh areas are opening up, hydraulic filling may be used to counteract this effect. Caution should be exercised to fill up the areas to the surrounding marsh levels or slightly higher to allow for compaction. Revegetation of the area will naturally follow, thus creating new marsh areas or stabilizing deteriorating ones.

6) Fixed and variable flow structures - the main objective of these structures is to control volume and rate of water exchange between the wetlands and estuarine waters. Their design will be governed by specific needs for management related to desired wetland habitats, water quality, and wetland use. Field structures will be used where the primary objective is to enhance retention of fresh water. Variable flow structures allow for seasonal control on water levels as needed for uses such as trapping.

7) Levees - artificial levees are structures used to protect already existing human habitats from floods and from hurricane surges. They should be designed to work as much as possible with natural processes and hydrologic regime.

8) Flood gates - these gates are structures used for water control. They are generally built in conjunction with levee systems. They can be operated to shut off, admit, or release massive amounts of water.

9) Treatment of surface runoff - Runoff treatment facilities collect, treat, and restore storm water to appropriate standard quality and discharge it at an appropriate rate of flow. Once treated, the water can be released into a buffer zone where it would be filtered by the vegetation and the soils before it is finally discharged into a watercourse or seeps into the groundwater.

10) Artificial barrier islands - manmade artificial islands are designed to mimic the function of natural barrier islands. They reduce the wave action upon eroding marsh shorelines and assure the necessary balance interchange between fresh water and saltwater.

11) Water diversion structures - this structural measure is used to introduce fresh river waters and sediment in a manner similar to the Bonnet Carré Floodway, but on a smaller scale. This measure would simulate riverine processes that have presently been stopped by the construction of artificial levees. Beneficial effects would be the restoration and build-up of wetland areas, counteraction of saltwater intrusion, and balancing of the natural process of subsidence in this area.

12) Waste treatment - waste water treatment plants are designed to treat waste water with the objective of purifying it before it is discharged into wetlands or open water bodies.

13) Drainage canals - canals are designed to collect runoff and storm waters and to direct them away from the fastlands. This insures protection to developed areas from excessive rain waters. Agricultural drainage ditches are designed to collect and carry runoff waters from agricultural lands. Design and operation of these ditches should not adversely increase downstream sediment loads or deteriorate the environment.

14) Pumps - artificial levees for flood and hurricane protection sometimes impound drainage during heavy rainfall. Pumps are generally used to withdraw the waters from these areas. They function as an outlet for the drainage system.

A selection of various combinations of the above measures can be used to modify and manage particular wetland areas. The selection of a specific technique will depend upon detailed studies of a designated wetland area, development of goals for management, and design of a modification system. Selection of specific study areas and management measures will be based on present wetland conditions, management needs, and the fastland/wetland relationship in regard to protection and enhancement goals.

B. ENVIRONMENTAL PROTECTION FEATURES

The actions necessary to fulfill some of the management needs and to implement some of the wetland management goals will require legislation, funding, technical services, and contracting. Depending on the nature and the scale of these actions, they might be implemented through non-structural and structural measures (environmental protection features) directly by the parish, or they may require state or Federal aid for implementation.

1. Non-structural Measures

At the parish level, non-structural measures such as zoning laws and ordinances can be used to help achieve the desired management goals. Developing local regulations for a local coastal zone management program is also an effective tool for controlling activities and uses within the wetland areas and on specific management units.

Some management goals could be more than local in nature. Their effects, if implemented, could affect a region (involving more than one parish), the state, or the nation as a whole (e.g., improvement of fisheries production). They may require non-structural state or Federal assistance so that implementation would be effective. Permitting programs, executive ordinances, rules and regulations which govern certain types of activities in wetlands, and floodplain areas of our nation will help in the achievement of set wetland management program goals.

2. Structural Measures

Many of the small scale structural measures discussed in the preceeding section can be carried out by the St. Bernard Parish government using equipment requested from the energy impact program. Some examples of structural measures geared to abate or reverse the present trends in wetland deterioration that can be carried out by the parish are discussed in Table 4-1. They are presented in terms of typical management solutions to avoid or counteract adverse impacts related to some specific practices such as navigation canals and pipelines.

One of the major causes of wetland deterioration in St. Bernard Parish appears to be closely related to the proliferation of deep navigation and drainage canals connecting the Gulf and interior wetlands. The overall impact of the canals on wetland quality depends upon the type and location of the canal and its present function or degree of operational maintenance (Table 4-1). Some of the more noticeable primary and secondary environmental impacts often attributable to canals are as follows:

1) saltwater intrusion
2) shoreline and canal bank erosion and consequent increase of water area at the expense of marshlands
3) destruction of fresh water flora and fauna and consequent loss of marshlands
4) establishment of brackish and saline tolerant flora and fauna farther inland at the expense of non-tolerant species
5) loss of stable, lower salinity estuarine nursery areas
6) loss of biological diversity as non-salt tolerant species are squeezed out by higher salinities
7) closure of oyster grounds near polluted canals
8) eutrophication of enclosed water bodies.

In order to minimize the present and future negative environmental impacts associated with canals, all existing canals in the parish should

MAN-MADE WORK	NEW PROCESS INITIATED	NATURAL PROCESS AFFECTED	IMPACT OF ENVIRONMENT	STRUCTURE TO MODIFY ENVIRONMENTAL IMPACT	NON-STRUCTURAL MEASURES TO MODIFY ENVIRONMENTAL IMPACT
Mississippi River Artificial Levee	a. Containment of Mississippi River flood waters	a. Periodic overbank flooding b. Periodic overbank sediment deposition c. Periodic overbank nutrient dispersal	a. Disruption of natural hydrologic regime b. Loss of silt to natural levee and wetlands c. Net loss in surface elevation d. Loss of nutrients to water bodies and wetlands e. Expansion of protected, developed fastlands at expense of wetlands	a. Restore annual water, and nutrient with construction of fresh water siphon b. Compensate for land loss through creative deposition of dredged spoil or Mississippi River sediment; or sediment from siphon sluice box sediment trap	
Land fill	a. Creation of fastlands and expansion of human habitats	a. Normal processes essential to wetland environments: 1. High water tables 2. Long term flooding 3. Growth of wetland vegetation and wildlife 4. Detritus input to estuaries 5. Wetland buffering 6. Flood water storage	a. Loss of wetland and aquatic habitats b. Loss of associated fish, wildlife, timber resources c. Loss of water filtering d. Loss of floodwater storage areas e. Loss of wetland buffer zone		a. Control erratic land fill through legislation, zoning, mitigation b. Control land filling to minimize immediate, long term and secondary impacts
Linear spoil banks	a. Water impoundment b. Growth of drier habitats and new species associations	a. Surface runoff b. Normal wetland processes	a. Destruction of wetland species in impounded water area and replacement by aquatic plants and open water b. Invasion of drier habitat plant and animal life c. Reduction in evapotranspiration rates with loss of wetland vegetation	a. Bulldoze spoil to wetland surface level b. Put culverts in spoil to reestablish through flow c. Cut breaks in spoil to reestablish through flow d. Align spoil parallel rather than perpendicular to natural flow	a. Legislate construction of spoil banks as to size, configuration, deposition and maintenance of flow through
Canals	a. Channelized and accelerated rate of fresh water run off	a. Surface runoff b. Normal, slow recharge of ground water and aquifers c. Flood water storage	a. Rapid, direct input of pollutants to estuarine and aquatic systems b. Rapid drainage of wetlands c. Lowering of water tables d. Displacement of destruction of wetland species	a. Permanent blockage of canal mouths b. Control of water flow via weirs, fixed or variable flow structures	a. Legislation to control canal construction, placement, configuration depth and maintenance according to acceptable environmental guidelines
	b. Channelized and accelerated rate of salty gulf waters into interior basins	a. Wetland buffering of flood and tidal stages b. Normal maintenance of salinity gradient from fresh interior through intermediate and brackish to saline gulf	a. Rapid, frequent, and often severe flooding of low-lying interior basins and natural levees b. Salt water intrusion into municipal fresh water supplies c. Backup of floodwaters in drainage canals, behind levees and in wetlands d. Displacement of saline and brackish marsh environments into interior basins e. Displacement or destruction of interior freshwater wetlands f. Loss of stable, lower salinity estuarine nursery areas g. Movement of less saline tolerant species inland h. Expansion of range of higher salinity tolerant species such as oyster drill	a-b. Same as above	a. Same as above
	c. Immediate removal of wetlands	a. Buffering of wind, wave, storm action b. Detritus formation c. Wildlife and fisheries habitat support base	a. Loss of fisheries and wildlife habitat b. Loss of primary food production source (detritus) to estuaries c. Loss of buffer zone for wind wave protection of fastland and pollution protection for wetlands	a. Same as above b. Fill in all canals that donot need to remain open c. Segment large canals into smaller units	a. Same as above
	d. Shoreline erosion	a. Environmental exchange along land water interface	a. Increase in ratio of water to land b. Decrease in land-water interface area and loss of maximum amount of biological exchange c. Loss of biological diversity	a. Same as above	a. Same as above
	e. Short-circuiting of nutrient cycle	a. Surface runoff and nutrient uptake by flora b. Plant filtering of surface runoff	a. Accelerated rate of eutrophication of enclosed fresh water bodies b. Lowering of wetland plant productivity	a. Same as above b. Selective reintroduction of nutrient laden fresh water by man	a. Same as above
	f. Short-circuiting of sediment cycle	a. Sediment entrapment by flora b. Maintenance of wetland surface elevations by offsetting natural subsidence rates	a. Accelerated rate of siltation of enclosed water bodies b. Accelerated rate of wetland surface subsidence	a. Same as above b. Selective reintroduction of sediment by man	a. Same as above
Hurricane protection levees	a. Impoundment of drainage waters and possibly storm/surges behind levees b. Point distribution of runoff waters into water bodies, canals, wetlands	a. Growth of wetland vegetation in impounded areas b. Disruption of fresh water surface runoff from levees c. Impoundment of saltier storm surge waters	a. Destruction of wetland vegetation in impounded areas b. loss of wetland plant productivity c. Destruction of or stress on fresh water plants and animals	a. Proper design and maintenance of protection levees, pumps and flood control gates b. Proper water level control behind levees c. Surface runoff discharge along non-point lines in wetlands	a. Legislation and enforcement of levee construction, distribution and maintenance
Weirs	a. Channel erosion along sides and base of weir b. Blockage of salinity gradient at weir	a. Movement of aquatic and marine species through channel b. Salinity gradient throughout channel	a. Barrier established; usually fresher behind weir b. Concentration of aquatic and marine species at weir; hinder species migration through channel and into interior marshes	a. Variable flow structure b. Removal of weir c. Construction of temporary weirs	a. Monitor weirs for detrimental or desired impacts; legislate and control their construction and maintenance
Abandoned structural debris	a. Wetland obstruction to flow of water and organic materials	a. Biodegradation of marsh materials b. Movement of water, fish, and wildlife	a. Unesthetic debris b. Hazard to some fish and wildlife c. Obstruction to navigation and fisheries harvest	a. Removal of obstructions	a. Legislate and monitor construction to ensure removal of unwanted or hazardous debris

Table 4-1. Specific Practices, Impacts, and Related Management Practices.

be evaluated in terms of their present purpose and their impact on the environment. If the canals are not needed for navigation, they should be permanently sealed at all points where they connect with larger water bodies and most especially with saline waters. Where canals are especially long and wide, they should be compartmentalized into smaller units to limit fetch length over which wave growth can occur. This procedure will reduce further canal loss due to wind- and boat-generated wave erosion.

In areas where canals are used for navigation and cannot be sealed, several measures are available for reduction of bank erosion by waves. A possible, but probably impractical, solution is the establishment and enforcement of boat speed limits. A more practical solution is an evaluation of all canals in terms of bank stability, type and frequency of boat traffic, rates of erosion, and type and feasibility of bank stabilization structures. Much research has been done recently, especially through sea grant agencies, on a variety of materials suitable for shoreline protection under varying circumstances. Plastic sheeting, natural vegetation mats, tires, balloons, floating booms, sea walls, groins, and revetments are just some of the possible shoreline protection measures. However, before any structures are implanted, studies must be done concerning their suitability, cost, maintenance, and environmental impacts.

In areas where marshlands have been replaced by open water, either because of shoreline erosion or saltwater destruction of fresh marshes, new marshlands can only be created through sediment deposition and marsh revegetation. In small, open water bodies, surrounding marsh vegetation would probably invade the sediment and naturally reestablish a brackish or saline marsh. In larger water bodies, actual marsh rebuilding may be possible only through man-made grass transplants and sediment stabilization until the vegetation is well established. A possible source of sediment is material dredged from channels and canals in the course of regular channel maintenance. Existing spoil banks along some canals, especially banks that presently impede surface runoff, may be leveled and their material utilized to fill in small, shallow, open water bodies near the canals. A major area that needs this type of marsh rebuilding lies immediately adjacent to and east of the MRGO. Material dredged from the MRGO should be placed in the enlarging water bodies east of the canal either to be revegetated naturally or by man. Because of the constant subjection of this shoreline to wave erosion, material stabilization measures will be required while the marsh is reestablishing itself.

Another major site experiencing marsh deterioration is the levee flank depression along the east hurricane protection levees. In the 1940s and 1950s this area supported a deep fresh water sawgrass marsh and bottomland hardwood-cypress forest. Saltwater intrusion via canals and broken flood gates has stressed and destroyed much of this vegetation. One immediate solution is permanent closure of the flood gates to prevent further saltwater intrusion behind the protection levees. A siphon or pump should be installed to lower water levels behind the levees and to prevent standing water which can also kill wetland plants. It is probably unfeasible to reestablish fresh marsh vegetation gulfward of the levees because of the frequency of saltwater intrusion either via canals or storm surges. Also, it is unlikely that brackish or saline marsh species will invade this area because of the naturally high water level. However, it is desirable to establish a marsh along the protection levee to buffer erosional forces directed at the levee and to filter water pumped from fastlands into the wetlands. In order to do this, it will be necessary to elevate the marsh surface to sea level or slightly above in order to enable brackish water grasses to become established. This can be accomplished through systematic deposition of spoil along the outer base of the protection levee. One possible source of sediment is material dredged from the sluice box at the Violet Canal fresh water siphon. Non-hazardous garbage may also be used to fill in deep areas prior to layering with clean sediment.

In order to ensure viable marshes outside of the protection levees, water pumped from the fastlands should be spread over the marshes rather than introduced at a few points along canals. Nutrients in these flood-waters will be absorbed by the vegetation, enriching their growth and lessening the nutrient overloading of the water bodies. Surface flooding of the marshes will also enable grasses to filter out pollutants and improve the quality of waters reaching oyster growing areas. Reestablishment of seasonal fresh water flooding will also benefit St. Bernard Parish wetlands to some extent. Probably the most notable and economically beneficial effect of this action will be seasonal destruction of oyster drills and other oyster competitors and predators associated with long-term high salinity levels. Sediment generated as a result of the fresh water diversion structures can be used to reestablish marshlands.

Maintenance of brackish marshlands for production of muskrats may require artificial control of water levels and salinities in addition to seasonal burning of wiregrass to promote establishment of three-cornered grass. A system of fresh water introduction and weirs to maintain desirable water levels would probably constitute an integral part of such management.

Because of their nature and size, larger scale structural measures will require assistance from the state or the Federal government. For example, some of the wetlands' problems directly related to saltwater intrusion, blockage of waterborne sediment, and prevention of seasonal Mississippi River flooding can be compensated for on a case-by-case basis with proper management techniques. Reversal of wetland deterioration could be initiated by reintroduction of fresh water and sediment on a massive basis, approximating conditions existing prior to leveeing of the Mississippi River and construction of the MRGO. Theoretically, abandonment of the MRGO for navigational purposes would greatly increase the options for wetland management in St. Bernard Parish. The parish can, through self-initiated efforts, fund part of the large scale structural measures. However, it will have to rely upon state and Federal technical and financial aid to fund some of the larger scale projects.

SECTION V: COMPLIANCE WITH STATE AND LOCAL ENVIRONMENTAL PERMITS AND PROCEDURES

A. STATE PERMITTING PROCEDURES

1. Requirements

A number of activities which would have an effect on the environment and which might be associated with the implementation of some of the structural measures advocated by the wetland management program would require permits from the State of Louisiana. These include a) discharge into waters, b) emissions into the air, and c) waste facilities.

a) Discharge into waters

A report is required before construction starts by the Louisiana Stream Control Commission for any type of activity which will discharge waste into the state's waters. The report should include a full description of the proposed action disposal system and the measures which will be taken to mitigate pollution. The report must be prepared and approved by a professional engineer duly licensed in Louisiana.

b) Emissions into the air

If a proposed facility will release matter into the air, a report must be submitted to the Louisiana Stream Control Commission through the Louisiana State Board of Health. The report must be submitted before construction starts, and should include a full description of the proposed action and measures that will be taken to protect air quality. The report must be prepared and approved by a professional engineer duly licensed in Louisiana.

c) Waste facilities

Permits for construction of water supply systems, sewerage systems, and solid waste facilities are required by the Louisiana State Department of Health and Human Resources. Applications should include complete construction and operating plans and sufficient engineering data for project evaluation.

2. Status of Permits

Prior to construction of any of the suggested structural measures, all required permits must be obtained and all applicable procedures followed.

3. Coordination with State Agencies

Louisiana Department of Transportation and Development - This department is presently developing guidelines for the state Coastal Zone Management Program (pending approval from the secretary of the U.S. Department of Commerce). The St. Bernard Parish Police Jury is coordinating its efforts with the state coastal zone management goals.

Office of Public Works - The department may be called upon to provide engineering services or advice, and would be in a position to insure coordination with other projects they may have in the area.

This office is providing engineering services to the Police Jury as well as to the Lake Borgne Basin Levee District for flood control, drainage, and other water resource developments. It is also presently working with the agencies in the improvement of existing drainage channels within the levee area, and is preparing plans for the construction of a pumping station at Kenilworth Canal. All of these projects are concurrent with the management goals set for the parish and with the concept of maintaining and providing a safe human environment in the fastland areas, and coordinating development with the wetlands management program's goals and plans.

Louisiana Department of Wildlife and Fisheries - the Department is interested in the beneficial effects that the wetland management program might have on fish and wildlife populations in St. Bernard Parish wetlands. Any activities which will require permits from this department will be coordinated with them.

B. LOCAL PERMITTING PROCEDURES

1. Requirements

The area is under the jurisdiction of the St. Bernard Parish Planning Commission and the St. Bernard Parish Police Jury. Permitting powers rest with the Police Jury.

The parish has land use control regulations which include zoning ordinances, subdivision regulations, pipeline dredge and fill ordinances, and parish geophysical and geological survey ordinances.

2. Relationships with Local Agencies

The parish has a Coastal Zone Advisory Commission. The wetland management program is an integral part of the present Coastal Zone Management (CZM) Program, and guidelines for its implementation are now being developed at the parish level and will be in accordance with the state's CZM Program.

3. New or Additional Permits

Any new or additional permits or procedures that are developed prior to construction of any structural measures will be obtained and followed.

SECTION VI: ENVIRONMENTAL SUMMARY

A. ENVIRONMENTAL PROBLEMS WHICH CANNOT BE SOLVED

1. Land Constraints and Resources

Since riverine processes and periodic flooding by Mississippi River waters have been stopped by artificial levees, wetlands building by aggradation and rejuvenation has also been stopped. On the other hand, erosion by marine forces and saltwater intrusion has precipitated the natural process of delta deterioration, and subsidence is a predominant factor. Consequently land loss is occurring at a rapid rate (CEI, 1976).

Delta deterioration is an irreversible process unless large volumes of fresh water and sediments can be reintroduced into the area mimicking a delta building process by the Mississippi River. The deteriorating process, however, can be detained and/or mitigated to some extent by proper wetland management measures.

2. Vegetative Resources

Although most of the environmental problems associated with the vegetative resources of St. Bernard Parish can be mitigated or solved through the application of specific structural or non-structural measures, the persistent subsidence of the land, with its accompanying loss of marshland, is an inevitable geologic process. Since the abandonment of the Mississippi River's St. Bernard delta, St. Bernard wetlands have been subsiding and are being replaced by open water. This geologic process has been accelerated by the leveeing of the Mississippi River which has prevented overbank flooding and sediment deposition. The degradation and destruction of the St. Bernard marshes are particularly severe in those areas east of the MRGO where large areas of open water allow waves to build and create an erosional environment.

Through the construction of barrier islands, the compartmentalization of canals, the use of water and sediment diversion structures, and the creative use of dredged material and siphon sediments, the subsidence/ erosion problem might be solved in selected areas; but it is doubtful that the continued loss of marshlands can be completely halted.

3. Wildlife Resources

The continual natural processes of land subsidence accompanied by erosion due to marine wave action has resulted in a significant loss of marsh habitat. It cannot be expected that structural implementation will fully mitigate this wetland deterioration. The marshlands of St. Bernard Parish were once considered prime habitat for muskrat (Ondatra zibethicus) (O'Neil, 1949); more recently, nurtia (Myocastor coypus) has also become a locally important species. As wetland deterioration continues, population levels of these furbearers may be expected to decrease in some areas.

A variety of waterfowl species are harvested annually from the St. Bernard marshlands (Beter, 1957; Carney and Sorensen, 1975). Waterfowl usage, especially by dabbling ducks, will be curtailed in those areas most affected by land subsidence and erosion.

4. Water Resources

Before construction of the extensive levee system in south Louisiana, the water regime of St. Bernard Parish was controlled by periodic over-bank flow of the Mississippi River and drainage off the natural levee. The prohibition of fresh water flow into the wetlands by the man-made levee system, and the intrusion of saltwater through subsidence and canalization have dramatically altered the hydrologic system of St. Bernard Parish. Although the effects of saltwater intrusion can be somewhat ameliorated by fresh water siphons and river diversion structures, it is doubtful that the problem can be remedied at the scale at which it has occurred.

Serious water quality problems may also be associated with the use of Mississippi River water as part of a wetland management program. The introduction of river water will no doubt lead to some increase in the concentration of coliform organisms and heavy metals within the wetlands. Although this increase can be monitored and regulated, the problem of pollution of the Mississippi River is massive and cannot be solved by the Parish government alone.

5. Aquatic Resources

Detrital input is a primary factor governing fish and shellfish production and is the starting point of the estuarine food web. The loss of marshlands to subsidence and erosion will decrease detrital input and lower the value of some areas as nursery grounds. As a result, fish and shellfish production may be depressed in these areas.

6. Economic and Social Impacts (Primary and Secondary)

The parish population characteristics and rate of growth are not expected to be greatly affected by the proposed action. Growth would be planned and recommended to occur within fastland and higher ground areas of the parish along the existing bayous' natural levees. Implementation of the wetland management program would completely discourage urban sprawl into wetland areas of the parish. Construction of some of the structural measures recommended is not foreseen to greatly increase employment in the parish, although the labor force would probably be local.

Economic benefits derived from the implementation of the wetland management program could be reflected in future quantity and value of commercial landings of fish and shellfish, as well as in the fur industry and in the outdoor recreation and tourist industry.

7. Recreational Resources

The only problem foreseen which cannot be resolved regarding recreational resources is the temporary disruption of these resources during construction of some of the structural measures envisioned. Long-term beneficial effects would offset any temporary or short-term inconveniences.

8. Archeological Resources

Two environmental processes having an adverse effect on cultural resources in St. Bernard Parish cannot be prevented from occurring. These are subsidence and complete destruction of Indian sites which have already become totally wave-washed. Subsidence, over the long-term, causes the burial of sites below the level of the marsh so that the retrieval of information from them is very difficult, if not impossible, with present technology. Estimates of subsidence of sites vary, but a middle figure is 30 cm (12 in) per century (Kolb and Van Lopik, 1958). In the future, excavation of submerged sites may become feasible.

A few sites in St. Bernard Parish are wave-washed shell middens, situated so that no protection can prevent their further deterioration. An example is 16 SB 97, a recently designated site situated at the southern end of the MRGO on the sandward side of Gardner Island. Wave attack has already completely destroyed the original midden, leaving only resistant shells and artifacts as a beach deposit. It is doubtful that prevention of this wave action would be possible or even worthwhile.

9. Agricultural Resources

There are no anticipated problems which cannot be solved which will affect agricultural resources of the parish as a result of the proposed wetland management program.

10. Mineral Resources

No mineral resources within the parish will be adversely affected by the implementation of the proposed action.

11. Existing Developments

Existing developed areas and future areas of development within fastlands and higher ground areas will not be adversely affected environmentally by the proposed action. The wetland management program will be coordinated with fastland management programs in a manner which will benefit and improve both areas.

12. Human Elements

The proposed wetland management program will not create any foreseen problems related to the human element which cannot be solved.

B. MITIGATION

One area requiring mitigation has been identified during the course of this impact statement. The following recommendations have been made. An archeological study should be conducted to make specific recommendations for the management of cultural resources in the parish. This should include a site-by-site evaluation of the feasibility and durability of taking protective measures to prevent further destruction to sites potentially eligible for nomination to the National Register of Historic Places. Sites not eligible for the National Register and situated so that further deterioration is unavoidable should be identified and designated as such. The study should also include recommendations for systematic, problem-oriented evaluation of a sample of existing undisturbed sites which are undergoing subsidence. The study should consider management of already totally subsided sites lacking surface expression. Such sites, which may lie many meters below the surface, are not detectable by ordinary archeological survey techniques, but may be encountered during dredging.

Regarding construction of structural measures, all cultural resources sites should be avoided. A qualified archeologist should delineate the extent of the sites within or near the construction site, or the areas directly affected by the operation of the structural measure being taken. The program should be conducted by a qualified archeologist in coordination with the Office of the Secretary of the Louisiana Department of Culture, Recreation, and Tourism (the State Historic Preservation Officer).

SECTION VII: SHORT-TERM AND LONG-TERM IMPACTS OF THE PROJECT

A. LAND RESOURCES

Short-term adverse impacts on land resources are expected to be minimal. They would be associated mostly with construction and/or implementation of some of the structural methods of the wetland management program.

Long-term impacts would be beneficial to land resources because the main long-term goals of the wetland management program are 1) to enhance the physically protective aspects of the wetland environment, and 2) to enhance the biologically productive aspects of the wetland environment. In order to achieve these goals, several management measures will have to be taken to prevent or mitigate loss of land resources as evidenced by erosion on small waterways, erosion along pipelines, erosion along the MRGO, saltwater intrusion, habitat destruction, and gulf front erosion, among others (See Figure 4-1).

B. VEGETATIVE RESOURCES

The distribution of vegetation types in coastal Louisiana is dependent upon a variety of edaphic and water conditions. Of these factors, water level and the salinity of the soil water appear to be the most important (Penfound and Hathaway, 1938).

Although under natural conditions species composition of wetland vegetation types is relatively stable, man's manipulation of important habitat factors can result in dramatic compositional changes in short periods of time (O'Neil, 1949). Through alteration of water levels and salinities associated with economic activities, man has changed the specific composition of many of Louisiana's wetland areas (Center for Wetland Resources, n.d.; Montz, n.d.; Nichols, 1959).

Structural measures initiated as part of a wetland management program can produce changes in important habitat factors. These measures are generally designed to control water level, flow, and quality; to minimize erosion; or to counteract land subsidence. Structural measures such as weirs and dams, levees, and variable flow structures act to control water levels, flow, and salinity.

Structures which tend to retard shore erosion in large canals and open bodies of water include old tires, plastic sheeting, revetments, and shell. Although these structures may demand a certain amount of vegetation habitat, their placement in highly erosional environments may be of great benefit in protecting wetland vegetation. If the structures are constructed so that normal tidal exchange can occur, the species composition and vitality will be preserved.

Artificial barrier islands placed offshore would also have no detrimental effects on terrestrial vegetation provided they did not dramatically alter water flow or salinities. If such islands are constructed, highly productive seagrass beds should be avoided.

In coastal areas, land lost to erosion or subsidence can be replaced by the creative use of dredged material and through the introduction of river sediment. In both cases, existing vegetation in the immediate disposal area will be killed or injured by waterborne sediments. The types of plants which will colonize the new substrate and which might be artificially established will depend on the water level, the salinity of the receiving waters, and to some extent on the nature of the material which is deposited.

A serious problem associated with the use of dredged material and sediments for creation of vegetation habitat is that many such materials contain high concentrations of heavy metals and other pollutants (Espey, Huston, and Associates, Inc., 1976). Heavy metals can supress plant growth and production and can be incorporated into plant tissues and eventually into the animal food chain (Lee, Sturgis, and Landon, 1976).

The deposition of dredged materials in tidal areas also influences the water energy regime which can ultimately affect local vegetation resources. Reduction of the tidal prism by filling in parts of estuarine water bodies can decrease tidal velocities leading to sediment deposition or a shift in the saline--fresh water boundary (Johnson and McGuiness, 1975).

The water levels of wetlands are an important determinant of the vegetation types. Areas with slight differences in water level are often occupied by different sets of plant species (Penfound and Hathaway, 1938; Palmisano and Newson, 1967). Structures that produce a change in the water level of a particular area are also likely to effect a change in the vegetation. Water level changes can be particularly critical in saline areas where vegetation does not invade areas with water levels deeper than 10 cm (4 in) (Penfound and Hathaway, 1938).

Besides altering water levels, water control structures can modify chemical and physical characteristics of water. These modifications can also affect vegetation composition. Structures such as weirs tend to stabalize water conditions and can increase the growth and diversity of submerged aquatic vegetation (Chabreck and Hoffpauer, 1962).

The chemical and physical characteristics of the water can also be modified by the introduction of large volumes of water via river diversion structures or siphons. Large pulses of fresh, nutrient-ladened water can improve the vigor of many of the marsh plant species (Palmisano, 1971). Although pulses of fresh water can lead to seasonal increases in growth, it is doubtful that a permanent change in vegetation can be produced unless fresh water flow is continued during the high salinity months of late summer and fall.

Associated with fresh water from the Mississippi River are large concentrations of pollutants, particularly heavy metals. As with the use of dredged materials, the use of river water as a wetland management tool has the possibility of increasing the concentration of undesirable substances in the vegetation resources, and perhaps eventually the animal food chain; although river water would be mainly used during high water levels in the river where coliform content is less.

C. WILDLIFE RESOURCES

The marshlands of St. Bernard Parish constitute the most important wildlife habitat in the parish. Historically, these wetlands have been important areas for the production of furbearers, especially muskrat (O'Neil, 1949), and as wintering areas for several species of waterfowl (Beter, 1957; Carney and Sorensen, 1975). The deterioration of these wetlands, due in part to the natural processes of land subsidence and erosion, has been accelerated by man-induced change. The most important of these problem factors are 1) the leveeing of the Mississippi River which deprives the marshes of fresh, sediment-laden water and nutrients, thus curtailing marsh building processes, 2) an extensive network of man-made canals which disrupt water flow through the marsh and increase saltwater intrusion, and 3) the construction of the MRGO Canal which has greatly increased marsh salinities and replaced marsh with open water and spoil deposits. The result has been a decrease in actual marshland acreage and a trend toward more saline conditions. Wildlife habitat has suffered in turn in terms of reduced diversity and quality.

Proposed implementation of structural measures to arrest wetland deterioration will have both short- and long-term impacts on wildlife resources. The use of siphons and water diversion structures will introduce sediment-laden fresh water and nutrients into the wetlands from the Mississippi River to simulate natural riverine processes of overbank flooding. Ideally, with the proper number and placement of such structures, this should enhance marsh building processes and create a salinity gradient of fresh to brackish to saline marshes. In particular, this should help maintain viability of brackish marshes in the face of saltwater intrusion. Long-term impacts of such measures would include a more diverse and productive marshland for furbearers such as muskrat, and better wintering habitat for waterfowl. Because the Mississippi River would be the source of fresh water input, constant monitoring of the water for coliform bacteria and heavy metals would be necessary.

The use of weirs, dams, and fixed and variable flow structures to control water levels and salinities and to improve access for hunters and trappers has met with varying degrees of success in other parts of the Louisiana coastal marshes. A major function of these types of structures is to maintain water levels during periods of low tide (Chabreck et al., 1978). Correspondingly, Spiller (1975) found significantly higher populations of ducks and wading birds in ponds behind weirs than in control ponds during low tides. Weirs also have a moderating effect on water salinity, preventing drastic changes in salinity levels (Chabreck et al., 1978). Weirs may also lower water turbidity in some areas (Chabreck, 1968). Larrick and Chabreck (1976) reported increased aquatic vegetation in weired ponds. However, weirs seemed to have little impact on muskrat and nutria usage (Spiller and Chabreck, 1975). The net impact on wildlife by these structures would seem to be increased waterfowl usage and better access to the areas by hunters and trappers.

The creative use of spoil as provided by maintenance dredging of the MRGO and hydraulic filling could essentially lead to the formation of additional wildlife habitat. Depending on the placement of the spoil and fill and the subsequent vegetative successional patterns, these areas could be utilized by various species of wildlife. In cases where large spoil levees are formed, such as along the MRGO, various terrestrial mammals such as rabbits (Sylvilagus sp.) and racoons (Procyon lotor) may inhabit the low to mid successional vegetation. Various non-game birds would also be expected to utilize the spoil area as shrub and mid-story vegetative species developed. If new marsh is created, it would be utilized by the usual wetland mammals such as nutria and muskrat, and also various wading birds.

Barrier islands have been shown to be important sites for nesting colonies of seabirds and wading birds (Portnoy, 1977). Since artificial islands are designed to mimic the functions of natural barrier islands, these areas should provide additional utilizable nesting habitat for seabirds and wading birds.

D. WATER RESOURCES

In order to institute changes in a wetland environment, it is necessary to manipulate the water regime. Most of the structural measures used in wetland management programs are designed to control one or more of the water regime parameters. In most instances the installation of such structures will cause a local temporary decline in water quality through an increase in turbidity and the possibility of a suspension of heavy metals and other pollutants from loose bottom sediments.

Structures which control water levels, such as weirs, dams, flow structures, and levees, can induce a variety of water quality changes. Many of the changes will be similar to those reported by Chabreck, Hoar, and Larrick (1978) in their study of weirs. At low tide the areas behind weirs tend to have higher water levels since the water can recede only as low as the top of the weir. Accompanying this moderation of the tidal effect is a moderation of water salinities. The rate of salinity change is lowered in weired areas and the salinity can be either slightly higher or slightly lower than the surrounding areas. Lowered turbidity also appears to result from the use of weirs. Significant impacts on water quality can also result from the use of siphons, river diversion structures, and other structural measures which introduce large quantities of fresh water into the wetlands.

The introduction of Mississippi River water, with its high concentrations of coliform organisms and heavy metals, may have a significant impact on water quality. Although the marshes have the capability of filtering out bacteria, some shellfish areas might have to be closed for certain periods of time (Odum, 1970). Input of heavy metals and pollutants into the parish waters could lead to long-term sub-lethal and lethal effects on vegetative, wildlife, and aquatic resources if the action is not managed and carefully monitored.

E. AQUATIC RESOURCES

The most important economic aquatic resource in St. Bernard Parish is the American oyster (*Crassostrea virginica*). In 1970, oyster harvest in Coastal Study Area II (comprising parts of St. Bernard and Plaquemines Parishes east of the Mississippi River) yielded close to 2 million pounds of oyster meats worth over $800,000 to oyster fishermen (Pollard, 1973). Oyster grounds have become endangered due to increasing saltwater intrusion in the parish. Water salinities that remain at 15 parts per thousand (ppt) or higher favor the oyster's main predator, the southern oyster drill (*Thais haemastoma*) (Chapman, 1959).

Implementation of structural measures, such as siphons and water diversion structures, would help to stall saltwater intrusion by introducing freshwater from the Mississippi River, and therefore would protect oyster grounds from the oyster drill. Tabony (1974), however, did not believe the water diversion canal at Bohemia, Louisiana, altered water salinities enough to appreciably affect the oyster drill. A number of such structures would probably be necessary for desired results. A potential hazard would exist to oysters from input of coliform bacteria and other pollutants into the marshes via the Mississippi River, therefore these waters would have to be monitored closely. Also a problem may exist near such structures due to increased sedimentation and siltation that would destroy oyster beds (Pollard, 1973).

The input of such sediment-laden fresh waters and nutrients into the wetland system would help rejuvenate marsh productivity and marsh building processes. A subsequent increase in detrital material, the base of the estuarine food web, would enhance the marshes as fishery production areas and shellfish nurseries. Freshwater input might also restore suitable habitat for freshwater finfish species. Saltwater intrusion due to the MRGO has evidently eliminated some freshwater species in the Biloxi marsh (Fontenot and Rogillio, 1970).

Water control structures such as dams, weirs, and fixed and variable flow structures would moderate drastic changes in salinities and thus help oyster production. Burleigh (1966) found that weirs located in the brackish marsh bordering Lake Borgne concentrated such species as the spotted sunfish (*Lepomis punctatus*), redear sunfish (*Lepomis microlophus*), pinfish (*Lagodon rhomboides*), and spotted gar (*Lepisosteus oculatus*). Blue crabs (*Callinectes sapidus*) were also concentrated behind weirs. Water salinities were not significantly altered. Herke (1968) noted that weirs blocked inward movement of marine organisms when water levels were below the weirs' crests. Thus, the water level structures may alter distribution of some aquatic resources and impede normal movement during certain periods.

Spoil deposition and marsh building by hydraulic fill in the short-term would be detrimental to fish populations due to increased turbidities, but in the long-term may provide additional production areas.

F. AIR IMPACTS

Air impacts should be expected to be of short duration during construction of some of the structural methods associated with the wetland management program. Temporary impacts such as noise, dust particles, and air emissions of construction equipment will not have any long-term adverse effects on the wetlands environment.

G. ECONOMIC AND SOCIAL IMPACTS (Primary and Secondary)

Construction, implementation, and operation of the St. Bernard wetlands management program will not adversely affect the long-term productivity of the wetlands. Short-term adverse effects, such as temporary reduction of fish production during construction of some of the structural measures, may be experienced in specific areas. However, long-term beneficial economic and social impacts will offset any temporary losses.

Introduction of fresh water into certain wetland areas, and determent of saltwater intrusion in certain wetland areas will result in a better habitat for fur bearing mammals, therefore resulting in an improvement of trappers' economic gains. Biological productivity of estuarine areas is also expected to increase, thus benefiting the fishing industry's economy. Maintenance of the wetlands that fringe the natural levees is also a long-term social benefit, since they provide a line of defense against storm surge to the developed areas.

H. RECREATIONAL AREAS

Water recreation may be temporarily disrupted or affected by construction or operation of some structural measures in specific local areas.

Long-term beneficial effects of the proposed project will include the provision of a diversity of healthy habitats to support certain estuarine dependent species and waterfowl, and the improvement of water quality and water levels and circulation in wetland areas; all of which will be beneficial to outdoor sportsmen and wetland recreationists.

I. ARCHEOLOGICAL RESOURCES

Short-term impacts may be caused by structural measures which may disturb archeological sites during the construction of weirs and dams, levees, siphons, and revetments. Disposal of spoil in marsh areas, hydraulic filling, and introduction of sediment may bury sites. If possible, sites determined potentially eligible for nomination to the National Register of Historic Places which may suffer these short-term effects should be located, and the projects designed so as to avoid them.

Some non-structural and structural measures will have beneficial long-term effects on cultural resources in St. Bernard Parish. Retardation of erosion along banklines and lake shorelines will decelerate destruction of sites in these locations. At present this is one of the greatest threats to cultural resources in the parish. Structural measures will have no long-term effect on preventing subsidence of sites; in fact, short-term effects may be adverse, and mitigation is suggested.

J. HUMAN ELEMENT

There are no foreseeable short-term or long-term adverse effects, including displacement of businesses or people, as a result of the wetland management program.

SECTION VIII: IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A. LAND RESOURCES

Implementation of a wetland management program will represent an irreversible and irretrievable commitment of land resources to the enhancement of the physically protective and the biologically productive aspects of the wetland environment.

B. VEGETATIVE RESOURCES

Some of the structural measures of a wetland management program will demand irreversible and irretrievable commitments of vegetative resources. Often the actual placement of a structural control will demand a commitment of vegetative habitat. In some cases, such as in the construction of levees, this commitment is quite substantial. The commitment of vegetative resources for erosion control structures, although sometimes permanent in nature, can often prevent a greater loss in vegetative habitat.

Development of structural measures in the wetlands can also demand a commitment towards the maintenance or the alteration of vegetation types. If structural measures substantially alter hydrologic characteristics on a permanent basis, changes in species composition and dominance may occur.

C. WILDLIFE RESOURCES

None of the structural implementations mentioned would necessarily have a irreversible impact on wildlife populations. Overall, the measures seem positive for wildlife. The St. Bernard wetlands represent a very dynamic and complex system in which management is needed to offset deteriorating conditions. However, none of the impacts can be expected to have absolute permanence.

D. WATER RESOURCES

Installation of permanent water control structures will entail a commitment of certain waters to artificial regimes or will alter present artificial regimes. Continued introduction of Mississippi River water may possibly lead to an accumulation of heavy metals in the bottom sediments of natural and artificial channels unless careful management and monitored actions are taken. These pollutants can be resuspended in the water column at a later date by dredging operations or other disturbances.

E. AQUATIC RESOURCES

In effect, the structural measures would help to offset somewhat irreversible conditions should saltwater intrusion continue to increase. Without management, losses of oyster and fishery resources would be expected as salinities increase. In the extreme, this deteriorating condition could become irreversible. The structural measures could be a positive influence on aquatic populations, but are not considered to be an irreversible or irretrievable commitment of aquatic resources.

F. RECREATIONAL RESOURCES

The wetland management program will represent a commitment to the enhancement of recreational resources of the St. Bernard Parish wetlands.

By enhancing the biological productivity and habitat diversity of the wetlands, the recreational resources of the parish will also be enhanced.

G. ARCHEOLOGICAL RESOURCES

Disposal of spoil, hydraulic fill, and the introduction of sediment may bury sites in cases where these measures cannot be relocated so as to avoid sites. Dredging associated with procurement of spoil and fill may damage subsided sites having no surface expression. The wealth of cultural resources in St. Bernard Parish makes both of these possibilities highly likely. While burial does not theoretically constitute an "irretrievable and irreversible" commitment of cultural resources (means of excavating these sites may be devised in the future), it should be considered as such for all practical purposes. These deeply buried sites will probably remain inaccessible and information about their locations may be lost. Dredging through all or part of buried sites will represent an irretrievable and irreversible commitment of a portion of the archeological data contained in the sites.

H. AGRICULTURAL RESOURCES

There will not be any irreversible or irretrievable commitments of agricultural resources which would be involved in the proposed action.

I. MINERAL RESOURCES

There will not be any irreversible or irretrievable commitments of mineral resources as a result of the implementation of the wetland management program.

J. EXISTING DEVELOPMENTS

Maintenance of the fastlands for safe human habitation and maintenance of the wetland areas as a productive and protective system represent an irreversible and irretrievable commitment of resources in construction materials, equipment, labor, and fuel utilized for this purpose.

K. HUMAN ELEMENT

There will be an irreversible and irretrievable commitment of people for the planning, design, construction, implementation, and maintenance of the wetland management program.

L. MISCELLANEOUS

Not applicable.

SECTION IX: FEDERAL AND STATE INVOLVEMENT

A. FEDERAL PROJECTS

The proposed project would not bridge, damage, or interfere in any way with the functions of the existing protection levees which traverse the study area and which were built by the U.S. Army Corps of Engineers. The proposed action will not interfere or impede navigation in the Mississippi River, the Violet Canal, or the MRGO.

B. STATE PROJECTS

Standard Form 424 has been submitted to the State Clearinghouse, Department of Urban and Community Affairs (Feburary 15, 1979) for A-95 review. No adverse comments have been received.

C. OTHER AGENCIES CONTACTED

A list of Federal, state, and local agencies contacted appears in Section 10 of this report. Some of these agencies do not directly involve themselves with the proposed action, but they do act in an advisory and review capacity.

D. COMMENTS RECEIVED

Significant agency comments in regard to the proposed action are as follows.

State of Louisiana
STATE PLANNING OFFICE
OFFICE OF THE GOVERNOR
Baton Rouge, Louisiana

EDWIN EDWARDS
GOVERNOR

DONNA M. IRVIN
EXECUTIVE DIRECTOR

February 26, 1979

Maria M. Urrechaga
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, Louisiana 70802

Dear Maria:

This is in reference to your recent letter requesting comment by this office on the following information dealing with the preparation of an environmental impact statement regarding the St. Bernard Parish wetland management program:

(1) Any identifiable conflicts or potential conflicts that might result with any active and proposed plans and regulations involving our agency from the proposed action.

(2) Any thoughts on the proposed action.

We are in possession of the St. Bernard Parish Police Jury grant application for the proposed project. After review of this document, we find no conflicts with any active or proposed plans and regulations. In addition, we are in concurrence with the suggested actions within the study area.

Thank you for the opportunity to comment. Please feel free to contact me should any further information be needed.

Sincerely,

Renwick P. DeVille
Policy Planner

RPD/jct

State of Louisiana

WILLIAM C. HULS
SECRETARY

DEPARTMENT OF NATURAL RESOURCES
LOUISIANA GEOLOGICAL SURVEY

February 13, 1979

Coastal Environments, Inc.
1260 Main Street
Baton Rouge, Louisiana 70802

Attention: Ms. Maria M. Urrechaga

Re: St. Bernard Parish Wetland Management Program

Dear Ms. Urrechaga:

This is to advise that we have no information to offer you at this time regarding this environmental assessment.

Very truly yours,

LOUISIANA GEOLOGICAL SURVEY

Harry L. Roland, Jr.

Harry L. Roland, Jr.
Assistant Director

HLR:FMM

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Post Office Box 1630, Alexandria, La. 71301

February 13, 1979

Ms. Maria M. Urrechaga
Landscape Architect/Environmental Planner
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, La. 70802

Dear Ms. Urrechaga:

In response to your request of February 9, 1979, I submit the following considerations:

1. An identified conflict, or potential conflict that might result with any active and proposed plans and regulations in regulating the use of wetlands is the locating of facilities such as homes, industry, etc. on prime farm land in lieu of other lands.

2. If development is to take place, as it surely will, prime farm land which is very limited in St. Bernard Parish should be retained for agricultural uses.

Sincerely,

Alton Mangum Acting
State Conservationist

State of Louisiana

Department of Transportation and Development

Edwin Edwards
Governor

George A. Fischer
Secretary

Office of Public Works

P. O. Box 44155 Capitol Station Baton Rouge, Louisiana 70804

February 15, 1979

Mrs. Maria M. Urrechaga
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, Louisiana 70802

RE: St. Bernard Parish Coastal Zone Management

Dear Mrs. Urrechaga:

I have your letter of February 9, 1979, requesting information from this office as to any proposed projects or activities that require consideration in your preparation of an environmental impact statement on behalf of St. Bernard Parish Police Jury and regarding the St. Bernard Parish Wetland Management Program.

The Office of Public Works is providing engineering services to the Police Jury as well as the Lake Borgne Basin Levee District for flood control, drainage and other water resource developments. We are currently working with those agencies in the improvement of existing drainage channels within the levee area. We are also preparing plans for the construction of a pumping station at the Kenilworth Canal. However, permit problems are presently being encountered by the Police Jury and Levee District.

Your environmental consideration should provide for the current development of hurricane and flood control levees as well as interior drainage, pumping station, flood gates, etc. in order to provide for the orderly development of the protected areas. Exterior drainage of course will be required as outfall canals for these flood control and drainage facilities.

You should contact the Levee Board, whose office is in Violet, Louisiana, and discuss with them in detail their plans in order to place these activities in proper concept. It will of course be necessary that you thoroughly familiarize yourself with the full array of flood control and drainage features in that area. We will be glad to discuss this information with you if you desire to do so after you contact the Levee Board.

Sincerely yours,

Arthur R. Theis

ARTHUR R. THEIS
CHIEF ENGINEER

ART:sl

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

ADDRESS REPLY TO
COMMANDER (dpl)
EIGHTH COAST GUARD DISTRICT
HALE BOGGS FEDERAL BLDG.
500 CAMP ST.
NEW ORLEANS, LA. 70130
(504)589-2961

16475

FEB 1 6 1979

Coastal Environments, Inc.
Attention: Ms. Maria M. Urrechaga
1260 Main Street
Baton Rouge, Louisiana 70802

Dear Ms. Urrechaga:

In regards to your request for information on the impacts of St. Bernard's Wetland Management Program on Coast Guard activities, I cannot make specific comments without reviewing the management plan. However, except for aids to navigation structures, we have no facilities or plans for any construction in the parish that could conceivably conflict with any management plans. In general, it is the Department of Transportation and Coast Guard policy to avoid impacting on wetlands unless there is no practical alternative, and then to take every action possible to mitigate or offset any impacts.

I am enclosing a list of Coast Guard programs that may help you identify any potential conflicts based on your management goals. If any are identified, please contact me at (504)589-2961 for consultation.

Sincerely,

P. C. Golden

P. C. GOLDEN
Lieutenant, U.S. Coast Guard
Environmental Assessment Officer

Encl:
(1) Coast Guard Programs

DEPARTMENT OF HEALTH AND HUMAN RESOURCES

OFFICE OF HEALTH SERVICES AND ENVIRONMENTAL QUALITY

P. O. BOX 60630

NEW ORLEANS, LOUISIANA 70160

EDWIN EDWARDS
GOVERNOR

March 1, 1979

Ms. Maria M. Urrechaga
Landscape Architect/Environmental Planner
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, Louisiana 70802

Re: EIS Preparation in behalf of St. Bernard Parish Police Jury - St. Bernard Parish Wetland Management Program

Dear Ms. Urrechaga:

Receipt is acknowledged of your letter of February 9, 1979 regarding the above captioned subject.

With regard to your general query concerning an identification of potential conflicts with governmental entities (reference your topic areas 1 & 2), the following is offered (as regards this Agency's concerns):

1. Basically, this office does not object to projects which suggest, by means of adequate and proper concern, wetlands usage through appropriate promotion, enhancement and maintenance techniques. Our position in this regard, it must be noted, is based solely upon our mandated concerns for the protection and, where possible, enhancement of environmental and personal health. Typically, natural resources management activities entertain, for the most part, separate and distinct objectives from those with which we are normally involved - especially when pollutants introduction and resultant abatement is of little consequence.

2. Current CEIP funding activities within the Parish of St. Bernard, as is our understanding, project the implementation of a fresh water diversion structure (Violet River Water Siphon) at Violet, La. In this regard, and as is somewhat contrary to that which we have previously suggested, our office does have a justifiable concern - that being the potential contamination of those shellfish propagation areas which may be reasonably expected to experience measurable river water intrusion and the introduction of pollutants therefrom. While a specific area of influence has not been demonstrated as yet, it seems reasonable to assume that as a result of bacterial contamination of certain of those shellfish productng waters during periods of siphon operation, selected areas may, of necessity and as is required by this Agency's participation in the National Shellfish Sanitation Program (NSSP), be required to be closed, whether permanently or temporarily, to oyster and other shellfish harvesting in order that we may insure a safe and wholesome consumer product from a <u>health</u> standpoint. Accordingly, the potential for such action should be taken into consideration in

the preparation of any related environmental assessment for the area.

We would, of course, be willing to discuss with you in greater detail our responsibilities and concerns.

Please advise if you need additional information or clarification in this regard.

Respectfully,

George E. Robichaux

George E. Robichaux
Acting Unit Administrator
Permits and Monitoring Unit

GER:fb

LOUISIANA AIR CONTROL COMMISSION

525 Loyola Avenue
Telephone 504 568-5121

P.O. Box 60630
New Orleans, La. 70160

March 7, 1979

Ms. Maria M. Urrechaga
Environmental Planner
Coastal Environments, Inc.
1260 Main St.
Baton Rouge, LA 70802

Re: St. Bernard Parish
Wetland Management
Program

Dear Ms. Urrechaga:

In response to your letter of February 9, 1979, we are providing the following information.

We know of no identifiable conflicts or potential conflicts that might result with any active and proposed plans and regulations involving this agency from the proposed action.

We have no thoughts regarding the proposed action in the study area.

Very truly yours,

Gus Von Bodungen

Gus Von Bodungen, P.E.
Chief, Air Quality Section
Office of Health Services
and Environmental Quality

KAM/ys

cc: Atly Brasher

United States Department of the Interior

FISH AND WILDLIFE SERVICE

111 East Main Street
Lafayette, Louisiana
70501

March 7, 1979

Ms. Maria M. Urrechaga
Coastal Environments, Inc.
1260 Main Street
Baton Rouge, Louisiana 70802

Dear Ms. Urrechaga:

Reference is made to your February 9, 1979, letter regarding the Environmental Impact Statement being prepared for the proposed wetland management program for St. Bernard Parish. The Fish and Wildlife Service (FWS) concurs in the obvious need to protect the wetlands of St. Bernard Parish. However, information provided in your letter is insufficient to determine any potential conflicts with FWS interests and responsibilities. It is suggested that we be consulted when specific actions, alternatives and methodologies are formulated for the St. Bernard Parish wetlands program.

For your information, we are enclosing copies of the FWS's guidelines for the review of fish and wildlife aspects of proposals in or affecting navigable waters, and FWS procedures for review of oil and gas exploration and development activities in or affecting navigable waters and wetlands. These guidelines prescribe the objectives, policies and procedures to be followed in the Service's review of proposals for work and activities in or affecting navigable waters and wetlands that are sanctioned, permitted, assisted or conducted by the Federal Government. We hope that these guidelines will be of some assistance to you in preparing a wetlands management program for St. Bernard Parish.

We look forward to meeting with you in the near future to discuss the various plans and alternatives developed for the subject program. Should you need further assistance, please contact Coastal Zone Management Coordinator Dick Stanek of this office.

Sincerely yours,

Cary W. Kerlin

Cary W. Kerlin
Field Supervisor

Enclosures: As Stated

E. EXISTING AND PROPOSED AREAWIDE PLANNING AGENCIES

The following existing planning agencies have authority over or concern for the project:

Louisiana Department of Transportation and Development - this agency is the coastal zone management coordinating agency for the state and is responsible for developing guidelines, determing needs, and establishing priorities for Coastal Energy Impact Program projects in Louisiana. An allocation process has been developed.

Regional Planning Commission, Jefferson, Orleans, and St. Tammany Parishes - this is a regional agency which also functions as a regional clearinghouse for A-95 review.

There are no other proposed planning agencies at the present time.

F. OTHER SOURCES OF FUNDING CONSIDERED

The parish might be in a position to fund some of the small scale structural management measures using equipment requested from the energy impact program. However, the larger activities, such as diversion structures, will require large amounts of funding and coordination with many agencies, consultants, and contractors.

In addition to its own funding through tax monies and revenue sharing, parish permits and ordinances, local enforcement, and other self-initiated efforts, St. Bernard Parish is going to have to rely upon state and Federal technical assistance and aid. Since the scope of the St. Bernard Wetland Management Program embraces the enhancement and protection of a resource value far beyond its own borders, it can expect to make use of a number of available programs, and also those programs to be developed in the future.

Some of the programs having relevance to the wetland management program are listed in Table 9-1.

Table 9-1. Federal Programs Relevant to the St. Bernard Parish Wetlands Management Program.

1. Land and Water Conservation Fund Grants. For planning, acquisition and development of public outdoor recreation areas and facilities.

2. National Register of Historic Places. To identify and register districts, sites, buildings, structures, and objects significant in history, architecture, archeology and culture.

3. Public Domain Grants for Historic Monuments. To preserve historic sites and their features.

4. Small Watershed Projects. To protect, manage, improve and develop watershed land and water resources including recreation, fish, and wildlife resources.

5. Water Bank Programs. To help preserve, restore, and improve migratory water fowl producing wetlands.

6. Coastal Zone Management Estuarine Sanctuaries Program. To assist in the acquisition, development, and operation of estuarine sanctuaries for the purpose of creating natural field laboratories to gather data and make studies of the natural and human processes occurring within coastal zone.

7. Coastal Energy Impact Grants. To prevent, reduce, or ameliorate unavoidable loss of valuable environmental or recreational resources resulting from coastal energy impact activity.

8. Small Beach Erosion Control Projects. To control beach and shore erosion to public shores not specifically authorized by Congress.

9. Small Flood Control Projects. To reduce flood damages through projects not specifically authorized by Congress.

10. Small Navigation Projects. To provide practical and economic means of fulfilling needs of general navigation through projects not specifically authorized by Congress.

11. Outdoor Recreation Technical Assistance. To aid in the development and operation of effective programs to meet public need for recreation and related environmental quality.

12. Construction Grants for Waste Water Treatment. To aid in construction of municipal sewage treatment works to meet state and federal water quality standards.

13. National Environmental Study Areas. To make available to elementary or secondary schools, sites or land resources which exemplify natural, social, or cultural principles of the environments so the sites may be used in educational programs.

14. Resource Conservation and Development Grants. To assist in initiating and carrying out long range programs of resource conservation and development including public water based recreation and fish and wildlife developments and water quality management.

15. Comprehensive Planning Assistance. Offers a broad range of planning and management activities including goal development, resource allocation, and program management.

16. National Registry of Natural Landmarks. To establish an inventory of the nationally significant areas of the U.S. and encourage their continued preservation.

17. Economic Development Administration. Assists in developing an economic planning process leading to the formulation of development goals and specific strategies to achieve these goals.

18. Archeological Investigations and Salvage. To investigate and recover historic and archeologic remains threatened by destruction due to Federal activities.

SECTION X: CONSULTATION AND COORDINATION WITH OTHERS

A. AGENCIES

The following is a list of Federal, state, and local agencies contacted in relation to the project.

1. Federal

U.S. Department of the Interior - Heritage Conservation and Recreation Service

U.S. Department of the Interior - Geological Survey

U.S. Department of the Interior - Geological Survey, Water Resources Division

U.S. Department of the Interior - National Park Service

U.S. Department of the Interior - Fish and Wildlife Service

U.S. Department of Commerce - NOAA - National Marine and Fisheries

U.S. Department of Agriculture - Soil Conservation Service

U.S. Department of Transportation - Coast Guard - Eighth District

2. State

Department of Health and Human Resources - Office of Health Services and Environmental Quality

Department of Natural Resources - Louisiana Geological Survey

Louisiana Department of Transportation and Development - Office of Public Works

Louisiana Department of Transportation and Development - Office of Coastal Zone Management

Louisiana Department of Community Affairs - Office of State Clearinghouse

Louisiana State Planning Office

Louisiana Department of Wildlife and Fisheries

State of Louisiana Stream Control Commission

Louisiana Air Control Commission

State of Louisiana Department of Culture, Recreation and Tourism - Office of State Parks

3. Local

Regional Planning Commission for Jefferson, Orleans, and St. Tammany Parishes

B. PUBLIC PARTICIPATION

The St. Bernard Parish Coastal Commission has been meeting every month and plans have been publically discussed along with public participation from parish residents and interested citizens. Records of minutes of these meetings are available from the Parish Police Jury.

C. PRIVATE PARTICIPATION

The following is a list of private organizations or businesses contacted in relation to the project.

Orleans Audubon Society

Ecology Center of Louisiana

Prescott, Follet, and Associates Consulting Engineers

Delta Chapter of the Sierra Club

ENVIRONMENTAL DISCUSSION

SECTION A: LAND USE

A. DEVELOPMENT IMPACT

A land use map of the impacted area and its surroundings in St. Bernard Parish is shown in Figure A-1. The natural levee along the Mississippi River and Bayous La Loutre and Terre-Aux-Boeufs offer the best land and opportunity for development. A mixture of agricultural, residential, commercial, and industrial land uses is concentrated along the levees, primarily those of the Mississippi River and Bayou La Loutre. These lands are protected by a levee system having floodgate control of all drainage and waste waters. Highways, roads, and railroads also take advantage of the higher, more stable soils found in the natural levees. Water transportation is an important element in the parish economy. Principal water arteries are the Mississippi River, Bayous La Loutre and Terre-Aux-Boeufs, and the MRGO; many other natural and artificial waterways are found throughout the parish. Pipelines for oil and gas distribution also criss-cross the parish in every direction.

Some of the recreational activities found in the parish, because of their nature, occupy areas within the levee lands. Others, such as hunting, fishing, and general outdoor activities, require open spaces and wilderness areas which are satisfied by the vast wetland and water areas within the parish boundaries. Existing land use categories according to the Louisiana State Planning Office are shown in Table A-1.

B. IMPACT ON OTHER COMMUNITY FACILITIES

The Chalmette National Historic Park at Chalmette is within the study area. The Biloxi Wildlife Management Area is also located in St. Bernard

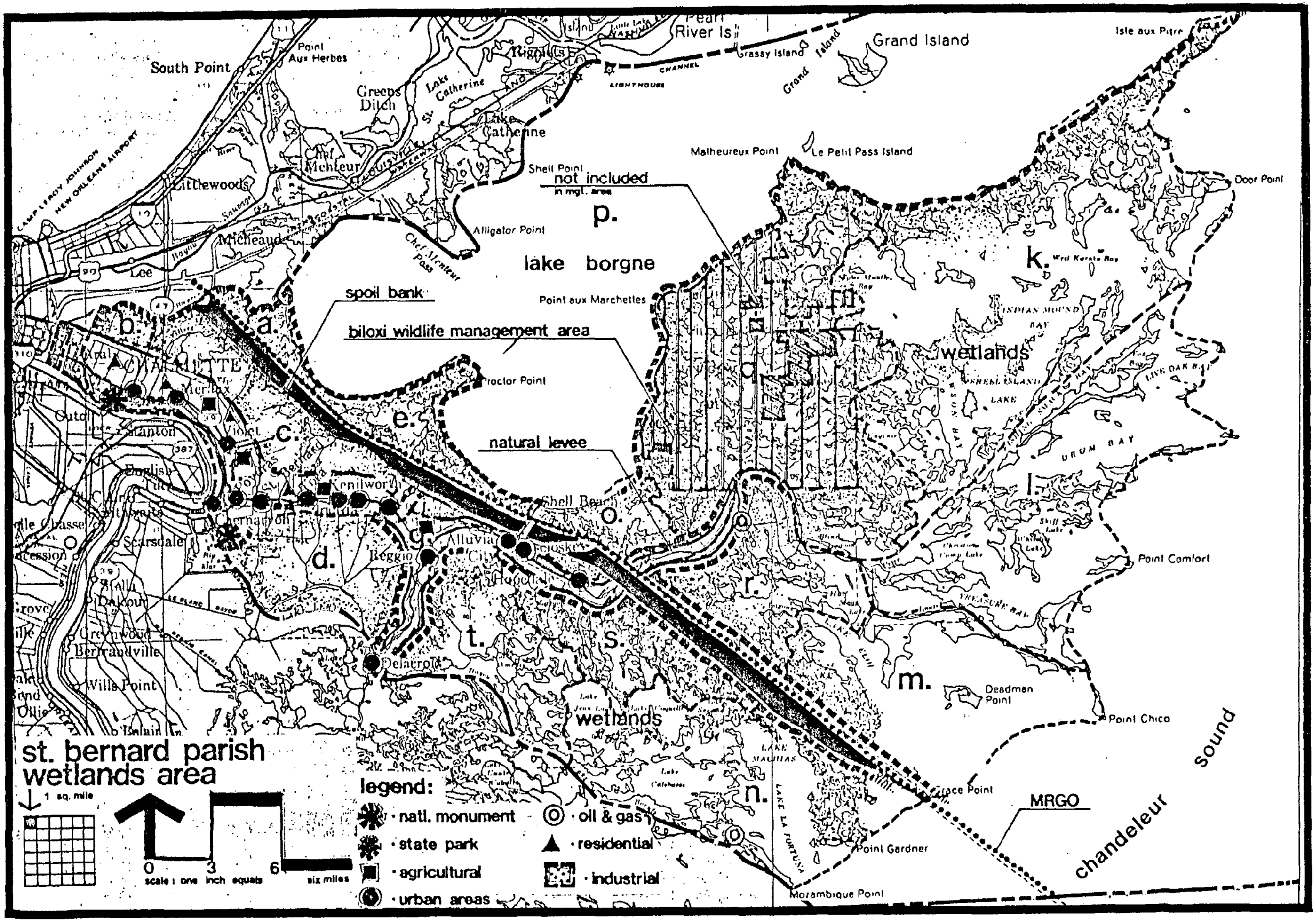

Figure A-1. Land use map, St. Bernard Parish, Louisiana.

Table A-1. Existing Land Use Categories, St. Bernard Parish.

Land Use Category	Acres
Urban and Built-Up Land	
Residential	4,446
Commercial and Services	247
Industrial	741
Extractive	0
Transportation, Communications, and Utilities	0
Institutional	0
Strip and Clustered Settlement	1,976
Mixed	0
Open and Other	741
Agricultural Land	
Cropland and Pasture	2,223
Orchards, Groves, Bush Fruits, Vineyards, and Horticultural Areas	247
Feeding Operations	0
Other	0
Rangeland—Not Applicable	
Forest Land	
Deciduous	10,374
Evergreens (coniferous and other)	0
Mixed	0
Water	
Streams and Waterways	5,928
Lakes	117,572
Reservoirs	2,223
Bays and Estuaries	342,589
Other	744,458
Wetland	
Forested	4,199
Non-forested	261,326
Barren Land	
Salt Flats	0
Beaches	2,470
Sand Other Than Beaches	0
Bare Exposed Rock	0
Other	25,441
Total Acreage	1,527,201

Source: Louisiana State Planning Office, 1972

Parish within the study area. None of these facilities will be adversely affected by the proposed project.

C. MAP INFORMATION

The map information related to the following sections is included in Figures 1-1, 1-2, and A-1, previously presented, or on individual maps related to the specific discussion topic.

D. GEOGRAPHY AND PHYSIOGRAPHY

Subaerial formation of St. Bernard Parish, as with most of coastal Louisiana, is the direct result of deltaic processes (Figure A-2). Deltaic processes have been demonstrated to be cyclic in nature (Coleman and Gagliano, 1964; Morgan, 1972) and can be divided into three distinct phases: constructional, abandonment, and destructional. During the constructional phases of deltaic growth, coarse inorganic materials are rapidly deposited and aggrade the land surface rapidly and natural levees are visibly dominant. As the rapid deposition of inorganic sediment slows and ceases, organic debris begins to accumulate from the extensive marsh areas which develop during the latter periods of the constructional phase of development. Associated with the slow accumulation of organic materials is the compaction and subsidence of underlying inorganic sediments lowering the land surface levels. The processes of subsidence are two-fold in the study area: they result not only from massive local sediment accumulations (natural levees), but also from a regional tectonic zone of subsidence, the Gulf Coast Geosyncline, which is active along the entire northwestern Gulf of Mexico. When the processes of subsidence exceed rates of sediment

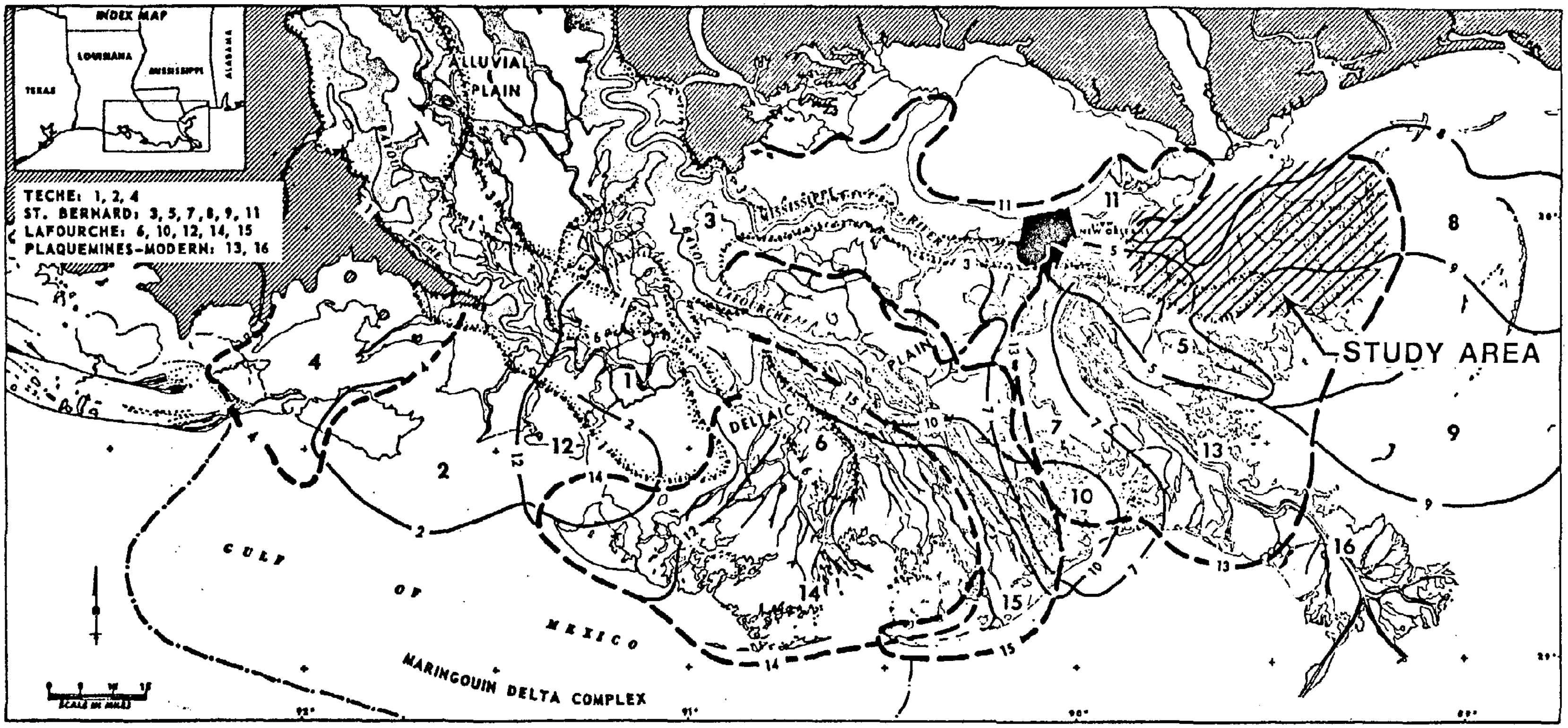

Figure A-2. The deltaic sequence of south Louisiana (After Frazier, 1967).

influx, the deltaic cycle enters into the abandonment phase. This phase is characterized by extensive bays, lakes, and levee flank depressions. When other sediment-laden waters are cut off from the distributaries, the destructional phase is reached. Deterioration of marshes and erosion of old natural levee features continue. The St. Bernard delta complex is in the destructional phase.

According to work by Frazier (1967), there have been seven episodes of deltaic activity which are responsible for the formation of much of the study area. The earliest of these began 4,600 years before present (B.P.) and terminated about 4,400 B.P. The last, and most important in terms of present subaerial physiography, became active about 100 B.P. and continued to be active in the study area until construction of flood control levees along the present Mississippi River course (Figure A-3).

As has been seen in the previous paragraphs, all of the material which constitutes the surficial stratigraphic units of the study area is of the Recent portion (within the last 500 years) of the geologic time scale. Due to the tectonic downwarping and transgressive sea level rise which has occurred in the Gulf of Mexico (Coleman and Smith, 1964), there are not outcrops of materials which represent earlier geologic time periods in the study area. In the study area Pleistocene materials are blanketed by at least 15 m (50 ft) of Recent deltaic sediments.

Physiographically, the study area is composed of three major types of landforms: natural levees, interdistributary basins, and marshes. Marsh area is the most dominant landform in the study area, comprising approximately 79% of the total area. Natural levees, built by the regular deposition of river sediments, flank the Mississippi River, Bayou La Loutre, and Bayou Terre-Aux-Boeufs. The higher elevations of the parish, ranging

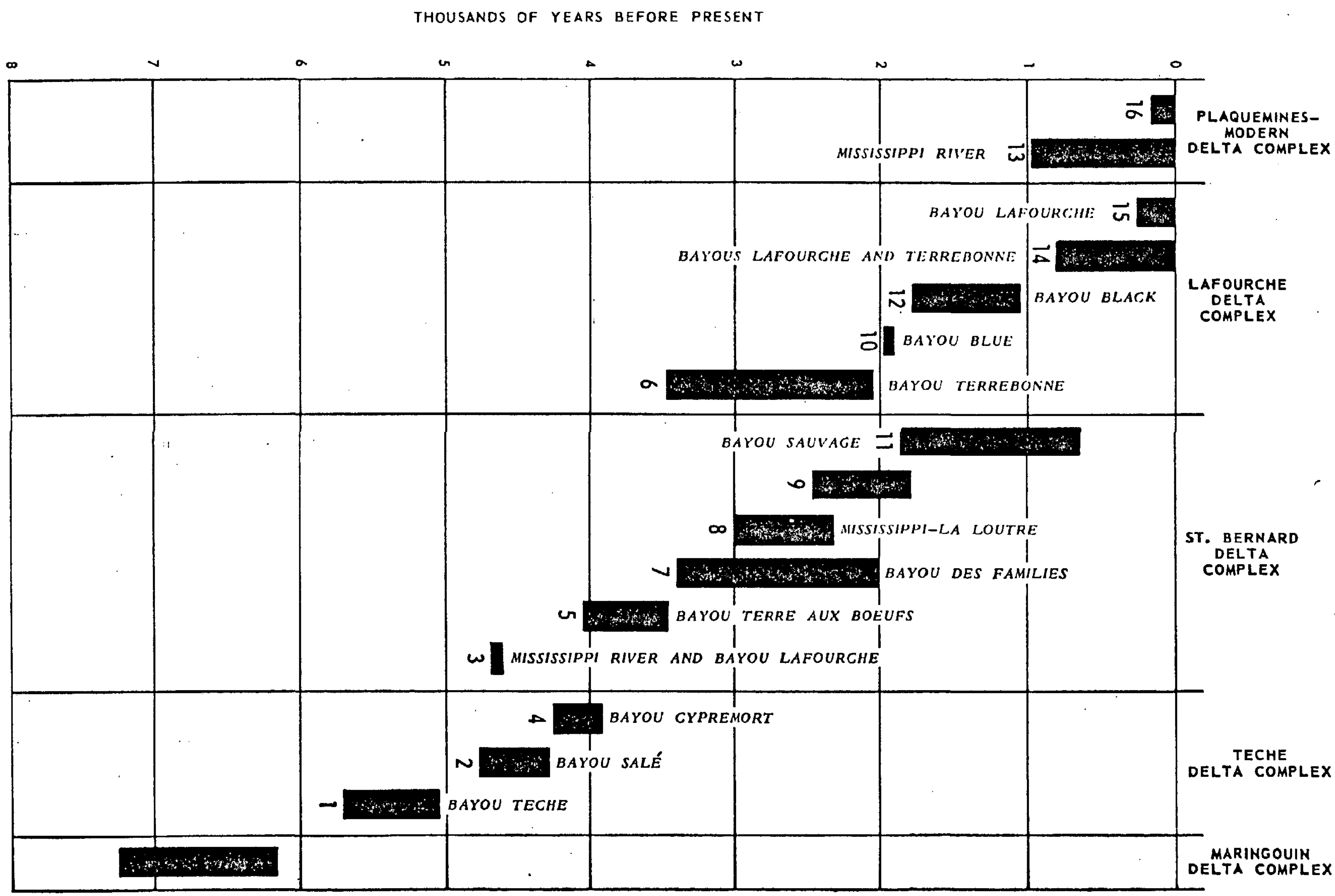

Figure A-3. Episodes of deltaic activity in south Louisiana.

from 1.5 to 3 m (5 to 10 ft), exist along the Mississippi River. Elevations up to 1.5 m (5 ft) are found along the other bayous and distributaries which criss-cross the area. Swamps are adjacent to some natural levees. Beyond the swamps are the fresh to brackish marsh which are at or just above sea level.

1. Structural Geology

Generally speaking, materials deposited by deltaic processes exhibit blanketing characteristics, i.e., they tend to conform to the surface trend over which they are being deposited. Thus, in the deltaic sediments of the study area, we find irregular bedding dipping generally in a seaward direction.

A result of deltaic activity in the study area is that it is tectonically very active. Local compaction of sediment and regional downwarping due to the massive weight of sediments across the northern Gulf of Mexico has produced a regional trough, the Gulf Coast Geosyncline. These are important agents of tectonic activity not only in St. Bernard Parish, but in all of coastal Louisiana (CEI, 1972). The processes of subsidence, both regional and local, are responsible for numerous faults which occur throughout the study area (Figure A-4). While these structural forces are active, their effect is felt less dramatically than in other well known areas of tectonic activity.

Seismic hazard in the study area is very low to non-existent (Algermissen, 1969; Algermissen and Perkins, 1976). Potential for seismic risk is described on a scale of 0 to 3 where Zone 0 means no damage, Zone 1 means

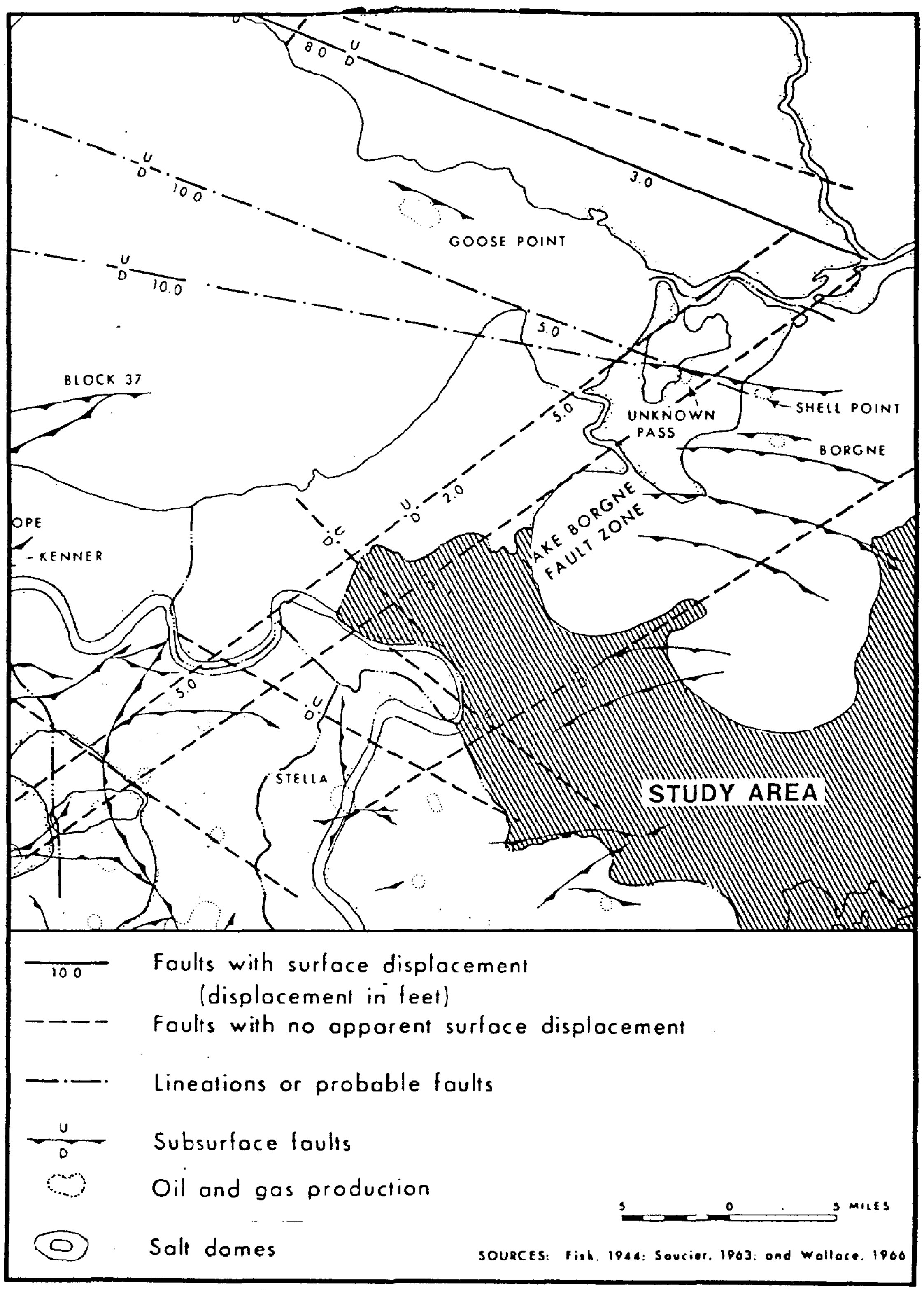

Figure A-4. Faults under parts of St. Bernard Parish and adjacent region.

minor damage, Zone 2 means moderate damage, and Zone 3 means major damage. Such a scale is based on historical data which considers only the intensity of the earthquake, not the frequency. The study area has a seismic potential of zero (Algermissen and Perkins, 1976), even though there have been two recent earthquakes. On October 19, 1930, an intensity VI (Modified Mersalli [MM] scale) earthquake was centered south of Donaldsonville at approximately 30°N latitude and 91°W longitude, or 80 km (50 mi) west of the study area. Some brick chimneys had their tops knocked down or were cracked in Gonzales, Louisiana, 24 km (15 mi) north of the epicenter. A second earthquake occurred on November 19, 1958, in Baton Rouge, Louisiana, 144 km (90 mi) northwest of the study area. An intensity of V (MM scale) is estimated for this earthquake which shook houses and rattled windows. The Baton Rouge fault is active and has moved .06 m/yr (.20 ft/yr) from 1959 to 1969 (Wintz et al., 1970).

2. Mineral Resources

Much of coastal Louisiana is underlain by extensive oil and gas fields. St. Bernard Parish is not as well endowned as many of the other coastal parishes in the state. There are some 24 oil and gas producing fields in the parish (Department of Conservation, 1973). Other extractive mineral industries, notably clay mining, occur in St. Bernard Parish.

3. Groundwater

St. Bernard Parish is underlain by three aquifers: the St. Bernard Delta "200 foot" sand; the "700 foot" sand, and the "1,200 foot" sand (USCE, 1975a). Table A-2 shows the characteristics of these aquifers.

Table A-2. Aquifers Under St. Bernard Parish.

Name	Description	Quantity of Water	Quality of Water	Current Use
200-foot sand	Point bars and distribution channel deposits. Old Course of Mississippi River	Small amount of fresh fresh water; recharge-rainwater	Poor	Developed to maximum limit
	West of Lake Borgne; 45 m (150 ft) thick	fair	Poor	Developed to maximum limit
	Western Edge of Parish and north of Mississippi River Thickness = 26 m (85 ft)	Poor	Poor	Developed to maximum limit

Source: USCE, 1975a

4. Soils

On the natural levees flanking the Mississippi River and its distributary channels, the soils are primarily of the Commerce-Sharkey Association (Figure A-5, Table A-3). Commerce soils at the higher elevations are composed of silt loam or silty clay loam surface and silty clay loam subsoil. Sharkey soils are generally found at lower elevations and are poorly drained. They have a dark gray, clay surface and a gray clay subsoil.

Commerce soils are better suited for building activities than Sharkey soils, which have a low bearing capacity. Commerce soils are also better suited for agricultural endeavors (although they, too, may need drainage) than Sharkey soils, which are generally more difficult to prepare for planting.

Swamp areas are flooded much of the time. These freshwater areas have soils composed of an organic surface layer .33 to one meter deep over firm to semi-fluid gray clays. After being drained, swamp soils have very severe limitations for most urban uses because of their low bearing strength, very high subsidence rate, and very high shrink-swell potential.

Marsh soils, which cover the major part of the parish area, consist of peat or muck underlain by slightly firm to semi-fluid gray clays. They are organic and mineral soils with high subsidence characteristics, low bearing strength, severe fire hazard potential, and very severe limiataions for must urban uses after drainage.

Soils on the spoil banks consist of excavated material from the dredging of new channels, such as the MRGO, and from the deepening and widening of natural channels such as Bayou La Loutre and St. Malo.

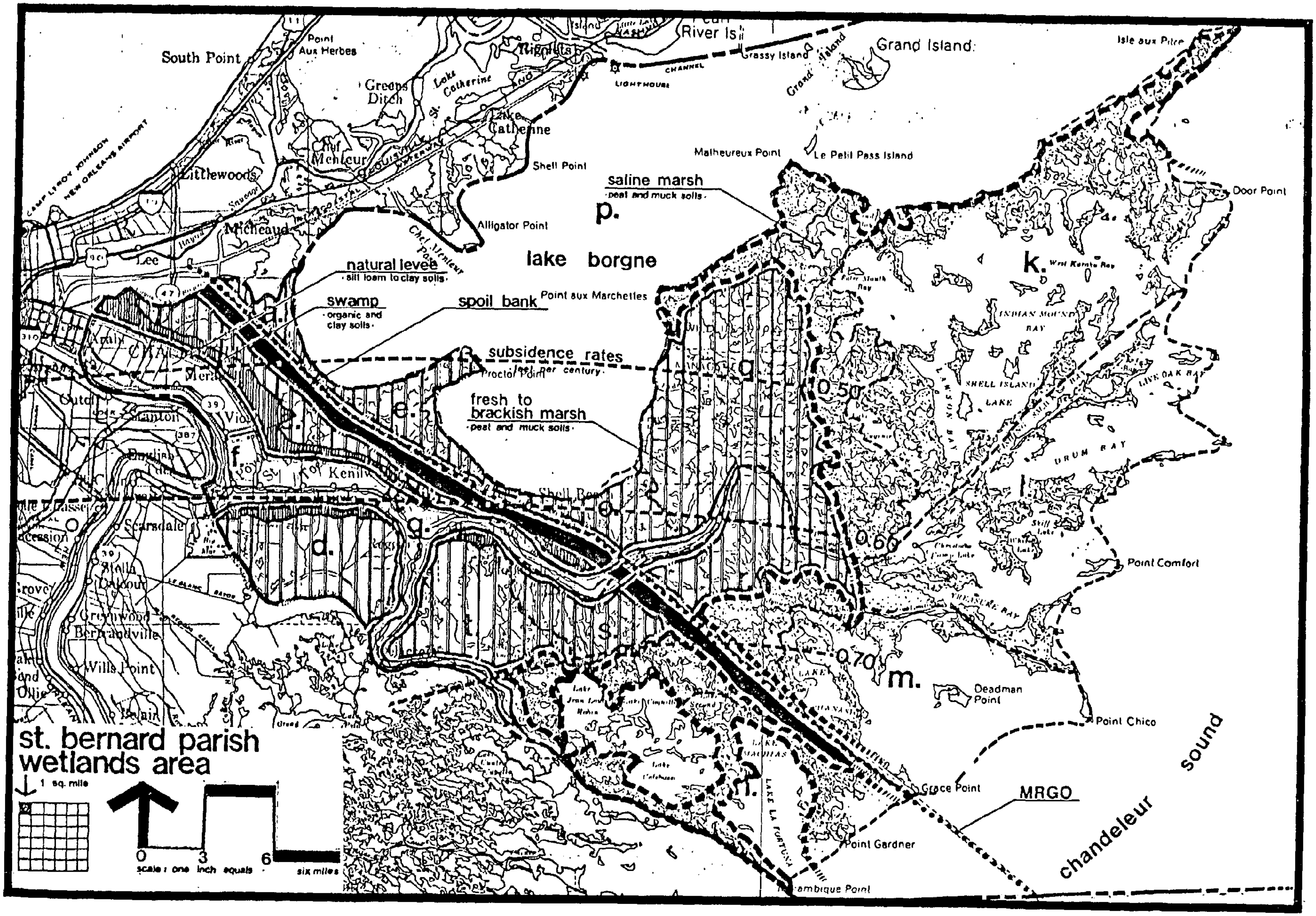

Figure A-5. Soil distribution, St. Bernard Parish, Louisiana.

Table A-3. Typical Soil Characteristics.

	NATURAL LEVEE		FRESH SWAMP	TO	BRACKISH MARSH	SPOIL & CANAL	LAKE RIM
SOIL ASSOCIATION	COMMERCE SHARKEY		FRESHWATER SWAMP	TO	BRACKISH MARSH	SPOIL	BRACKISH MARSH
TYPICAL SOIL TYPE	COMMERCE SILT LOAM	SHARKEY CLAY	ALLEMANDS PEAT	MAUREPAS MUCK	LAFITTE MUCK		KENNER MUCK
GENERAL SOIL CHARACTERISTICS	MINERAL SOILS WITH CONSOLIDATED CLAYEY OR LOAMY LAYERS; TYPICALLY HIGHER	MINERAL SOILS WITH CONSOLIDATED CLAYEY OR LOAMY LAYERS THROUGHOUT.	MINERAL SOILS WITH THIN ORGANIC SURFACE LAYERS; ORGANIC SOILS UNDERLAIN BY CLAY.	ORGANIC SOILS WITH 5-12 FT. OF WOODY ORGANIC MATERIALS; LOG LAYERS, STUMPS, SEMIFLUIDS.	ORGANIC SOILS WITH 5-12 FT. OF HERBACEOUS ORGANICS OVER SEMIFLUID CLAYS.	RESULTS IN AN INVERTED SOIL PROFILE OR MIXTURE OF ORGANICS & CLAYS	5-12 FT. OF HERBACEOUS ORGANIC SOILS
GENERAL ENGINEERING CHARACTERISTICS	LOW SUBSIDENCE POTENTIAL; LOW TO VERY HIGH SHRINKAGE POTENTIAL; NO PILINGS FOR ONE OR TWO STORY BUILDINGS; MODERATE TO SEVERE LIMITATIONS FOR MOST URBAN USES AFTER DRAINAGE.	LOW SUBSIDENCE POTENTIAL, LOW TO VERY HIGH SHRINKAGE POTENTIAL; NO PILINGS FOR ONE OR TWO STORY BUILDINGS; MODERATE TO SEVERE LIMITATIONS FOR MOST URBAN USES AFTER DRAINAGE.	MEDIUM TO HIGH SUBSIDENCE POTENTIAL; VERY HIGH SHRINK-SWELL POTENTIAL AND LOW BEARING STRENGTH; MOST ONE OR TWO STORY BUILDINGS REQUIRE PILING. SEVERE LIMITATIONS FOR MOST URBAN USES AFTER DRAINAGE.	VERY HIGH SUBSIDENCE; SEVERE FIRE HAZARD; LOW BEARING STRENGTH; IRREGULAR SUBSIDENCE; ONE OR TWO STORY BUILDINGS REQUIRE PILINGS. SEVERE OR VERY SEVERE LIMITATIONS FOR MOST URBAN USES AFTER DRAINAGE.	VERY HIGH SUBSIDENCE; SEVERE FIRE HAZARD; LOW BEARING STRENGTH; ONE OR TWO STORY BUILDINGS REQUIRE PILINGS. VERY SEVERE LIMITATIONS FOR MOST URBAN USES AFTER DRAINAGE.		HIGH SUBSIDENCE SEVERE FIRE HAZARD; PILINGS REQUIRED VERY SEVERE LIMITATIONS FOR MOST URBAN USE.
SUITABILITY TOP SOIL HIGHWAY SUBGRADE & BASE RESIDENTIAL FILL	GOOD FAIR TO POOR GOOD	POOR POOR TO NOT SUITABLE POOR	NOT SUITABLE NOT SUITABLE NOT SUITABLE	NOT SUITABLE NOT SUITABLE NOT SUITABLE	NOT SUITABLE NOT SUITABLE NOT SUITABLE		NOT SUITABLE NOT SUITABLE NOT SUITABLE
DEGREE OF LIMITATION HOMESITES - LIMITED INDUSTRY LANDSCAPE - GARDENS - LAWNS PLAYGROUNDS - PICNIC AREA STREETS AND ROADS	DRAINED / UNDRAINED MODERATE / NOT RATED SLIGHT / NOT RATED MODERATE / NOT RATED MODERATE / NOT RATED	DRAINED / UNDRAINED SEVERE / NOT RATED SEVERE / NOT RATED SEVERE / NOT RATED SEVERE / NOT RATED	DRAINED / UNDRAINED SEVERE / VERY SEVERE SEVERE / VERY SEVERE SEVERE / VERY SEVERE SEVERE / VERY SEVERE	DRAINED / UNDRAINED VERY SEVERE / VERY SEVERE SEVERE / VERY SEVERE SEVERE / VERY SEVERE VERY SEVERE / VERY SEVERE	DRAINED / UNDRAINED VERY SEVERE / VERY SEVERE SEVERE / VERY SEVERE SEVERE / VERY SEVERE VERY SEVERE / VERY SEVERE		DRAINED VERY SEVERE SEVERE SEVERE SEVERE
DRAINAGE FACTORS	NO SIGNIFICANT FACTOR	NO SIGNIFICANT FACTOR	HIGH SUBSIDENCE, FIRE HAZARD POOR TO FAIR SLOPE STABILITY	HIGH SUBSIDENCE. SEVERE FIRE HAZARD POOR SLOPES	VERY HIGH SUBSIDENCE; FIRE HAZARD, POOR SIDE SLOPE STABIL.		HIGH SUBSIDENCE FIRE HAZARD

Source: U.S. Department of Agriculture, 1970

They consist of a mixture of mineral soils, peats, and other organic matter. Spoil banks are thus a mixed-up version of the geologic section of the area in which they are located.

E. HYDROLOGIC ELEMENTS

The basic hydrologic structure of St. Bernard Parish is related to a pattern of abandoned distributaries of an ancient Mississippi River Delta complex. The head of the delta appears to have been near the junction of Bayou Petre and Bayou La Loutre. From this point, streams radiated outward like stretching fingers. Additional distributaries, such as Bayou Terre-Aux-Boeufs and Bayou Yscloskey, were established to the west (Figure A-6).

Composing the general drainage pattern are two types of channels: those related to the former delta growth, such as the distributaries and channels established by crevassing, and those developed as drainage of interdistributary areas. Most channels now function as tidal streams, winding through the marsh areas in a sinuous fashion. They are usually deep and allow passage of great quantities of water in an exchange between the marshes, Lake Borgne, the Mississippi Sound, Chandeleur Sound, and the Gulf of Mexico with each rising and falling of the tide.

The hydrologic setting is rapidly changing as a result of subsidence and the action of waves and currents. These processes have become increasingly dominate ever since the last distributaries were cut off from the Mississippi River source of sediment and fresh water by man-made levees. Without sediment deposition and land building, Gulf waters have progressively invaded the coastal marshes, forming numerous bays, lakes, and ponds.

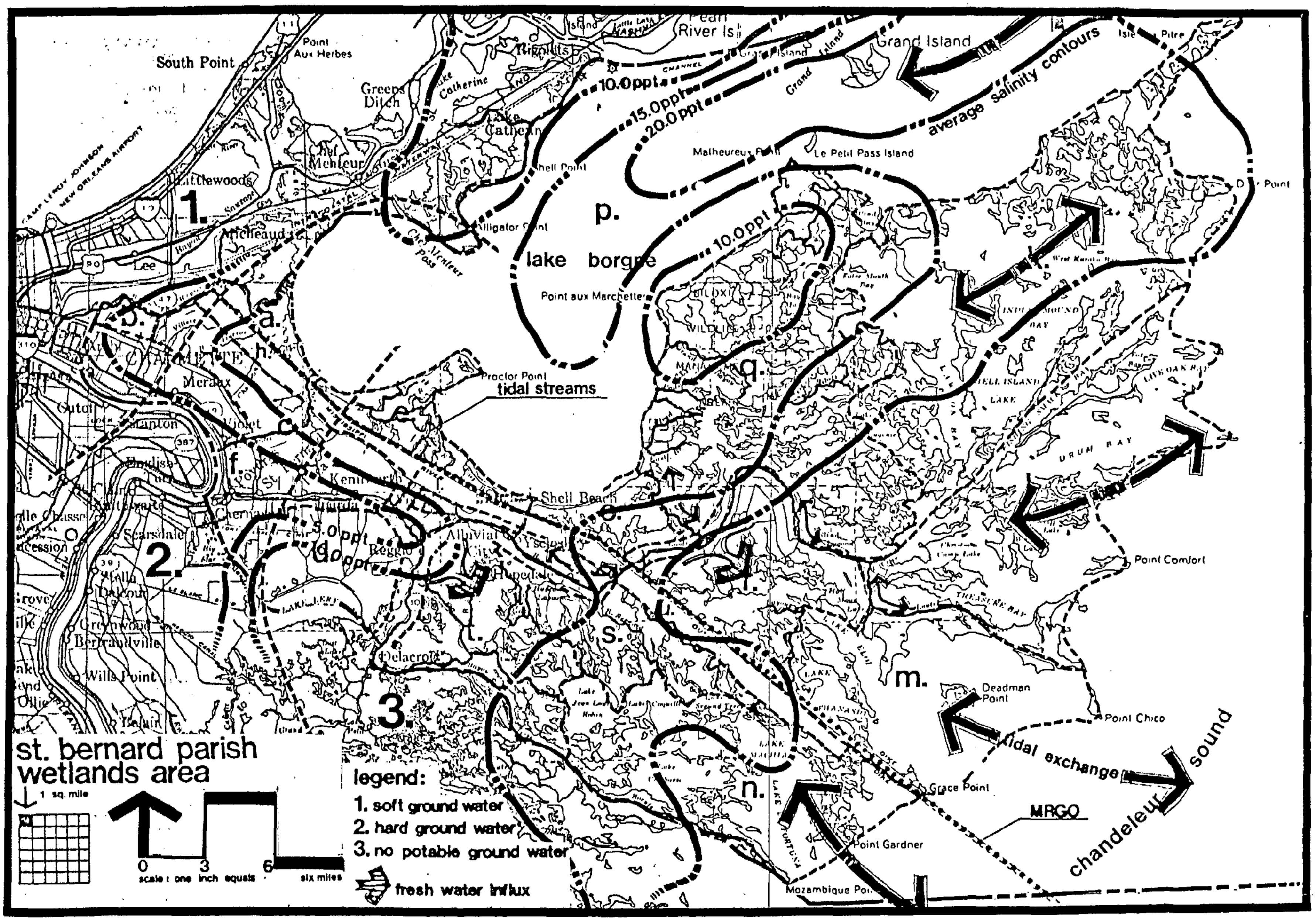

Figure A-6. Hydrology patterns, St. Bernard Parish, Louisiana.

Theoretical water movement based on tidal regime in the study area has a regular diurnal regime; water movement in the study area is much more complicated. Winds, rather than tides, have been shown to have a much greater effect on water movement. Work by Stone, *et al*. (1972) has shown that water movement in Lake Pontchartrain is related to wind direction. Direction of water movement has been found to generally follow in the direction to which the wind is blowing, i.e., a wind from the north will produce a net water movement to the south. This phenomenon will have an important effect on mixing and movement of introduced water.

Wind direction based on January through June at Moissant Airport, New Orleans, Louisiana, indicated predominantly a south and east wind 54% of the time. Winds from these quadrants should produce a net landward movement of water producing a "stacking" of water in the north and west portions of the project area. Winds with a northerly component affect the study area 29% of the time, producing a net lowering of water levels in the study area to the west of the MRGO, and aiding in the seaward movement of water. Winds with a northerly component should also allow freshened waters to be introduced into the marshes fringing the western shore of Lake Borgne.

F. CLIMATOLOGY

The Violet siphon site in St. Bernard Parish has a humid, subtropical climate associated with the latitude of the region and its proximity to the Gulf of Mexico.

1. Temperature Distrbution

Annual average temperature in the study area is 20°C (69°F). The average January temperature is 13°C (55°F), and the average July temperature is 27°C (80°F). During the summer months the days are hot with predominant southeasterly winds. The fall season is generally warm, and freezes are uncommon. Usually winter months are rather mild and cool, but cold fronts accompanied by northerly and northwesterly winds are common.

2. Rainfall Distribution

Precipitation averages 153.67 cm (60.50 in) annually. The winter and summer seasons are generally the rainiest. Precipitation during the winter months, and to some extent during the summer, is frontal. The monthly precipitation mean for the winter season is 11.50 cm (4.6 in), and 13 cm (5.2 in) for the summer season.

3. Humidity

Although humidity is high all year around, it is higher during the summer season.

4. Winds

Average wind velocity is 14 km per hr (8.6 mi per hr). During the early morning hours, winds on Lake Borgne are variable, shifting often to easterly during the afternoon. Winds from the northeast and northwest cause whitecaps and breakers in waters along the south shore. The southern part of the lake is calm when the winds are from the southeast.

During the summer months winds are predominantly southerly (southeast or southwest), and during the winter season northerly winds (northeast or northwest) predominate.

5. Hurricanes and Cyclones

Tropical storms and hurricanes may cross the area from late May to early November. These devastating storms can cause severe damage to people, property, and the environment. The erode the coastline, temporarily destroy wildlife habitats, and increase salinity levels in the marshes. The paths of several of these tropical storms and hurricanes, which may occur in the study area once or twice every five years, are shown in Figure A-7.

G. FLOODPLAINS

St. Bernard Parish lies in an area which, before man's modification of the environment, was periodically flooded by Mississippi River waters. Run-off from precipitation and overbank flow ran down the natural levee ridges and moved through interdistributary basins into the lakes or the Gulf of Mexico. Wetlands were tidally influenced, and free water and salinity exchange predominated.

Artificial levees now protect the flank of natural levees and urban developments from overbank flow, tidal flushing, and storm surge. Maximum storm surge heights experienced along the Gulf Coast range between 3 and 4.8 m (10 and 16 ft). Theoretical storms have been used for computing flood elevations and frequencies in order to devise a flood protection plan for the Lake Pontchartrain and vicinity area. Maximum surge contours

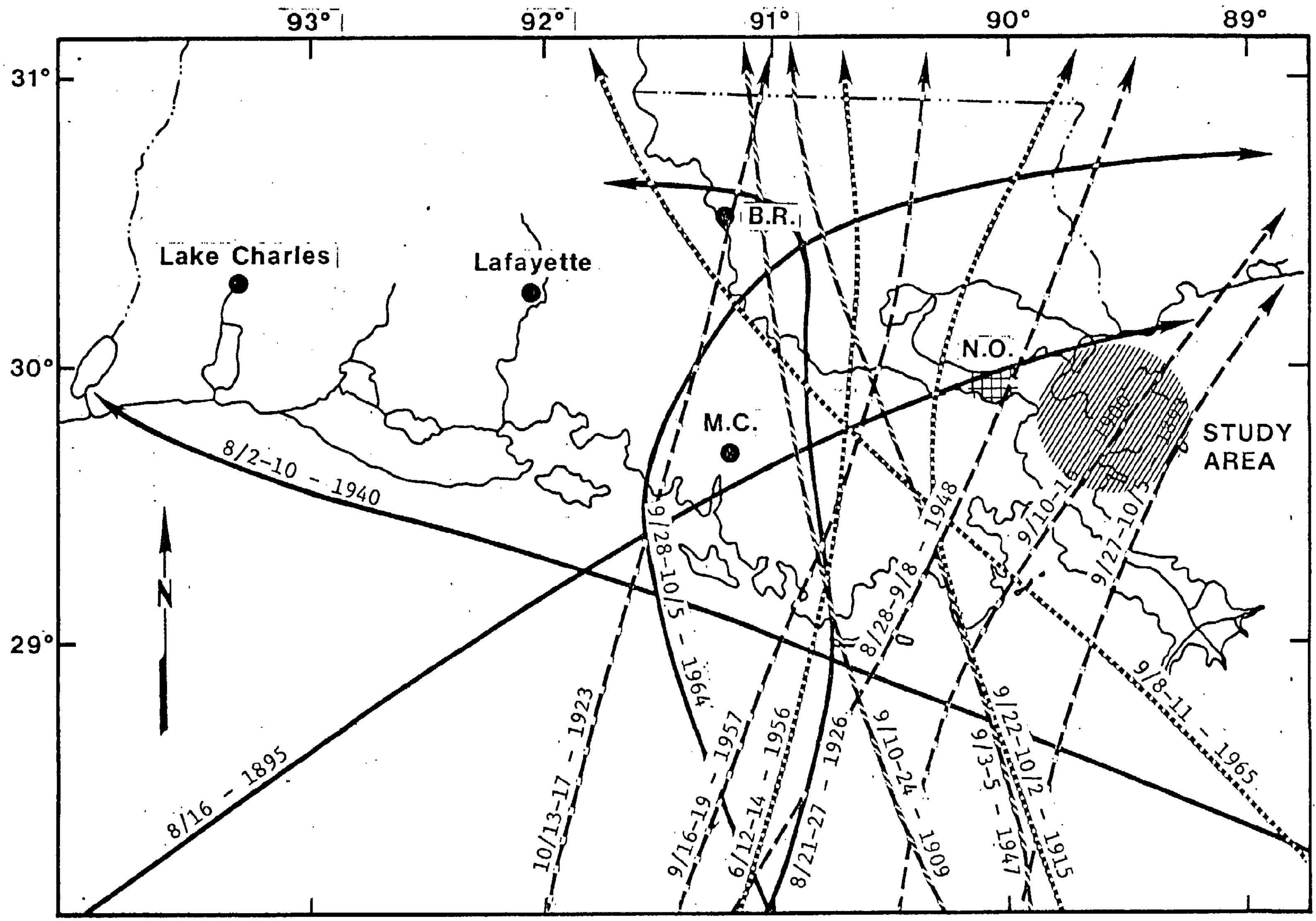

Figure A-7. Paths of hurricanes in the vicinity of the St. Bernard Parish Study Area (After USCE, 1962).

predicted for a portion of this area that might be generated by "moderate," "standard," or "maximum" hurricanes are shown in Figures A-8, A-9, and A-10.

The highly urbanized areas of St. Bernard Parish are surrounded by levees (Figure A-11). The levee system is designed to protect the area from flooding by the 100 yr frequency hurricane. It provides for a levee "27.8 miles in length along the southern shore of the MRGO from the Inner Harbor Navigation Canal (IHNC) to a point approximately 6 miles southeast of Bayou Dupre, thence southwest to Verret, thence west to the Mississippi River levee at Caernavon, Louisiana." (U.S. Army Corps of Engineers, 1974).

H. WETLANDS

The variety and abundance of vegetation types in St. Bernard Parish are closely associated with its topography, soils, salinity distribution, and humid sub-tropical climate (Figure A-12). Along the highest, unaltered portions of the natural levees, limited stands of hardwood forest are still present, however most of the original forests have been cleared for agriculture and urbanization. The best drained areas of the natural levees typically support trees such as the live oak (*Quercus virginiana*), southern magnolia (*Magnolia grandiflora*), hickory (*Carya* spp.), pecan (*Carya illinoesis*), sweetgum (*Liquidambar styraciflua*), American elm (*Ulmus americana*), cottonwood (*Populus deltoides*), and green ash (*Fraxinus pennsylvanica*). On levee areas that are less well drained, the more common species are water oak (*Quercus nigra*), sycamore (*Platanus occidentalis*), and willow (*Salix* spp.).

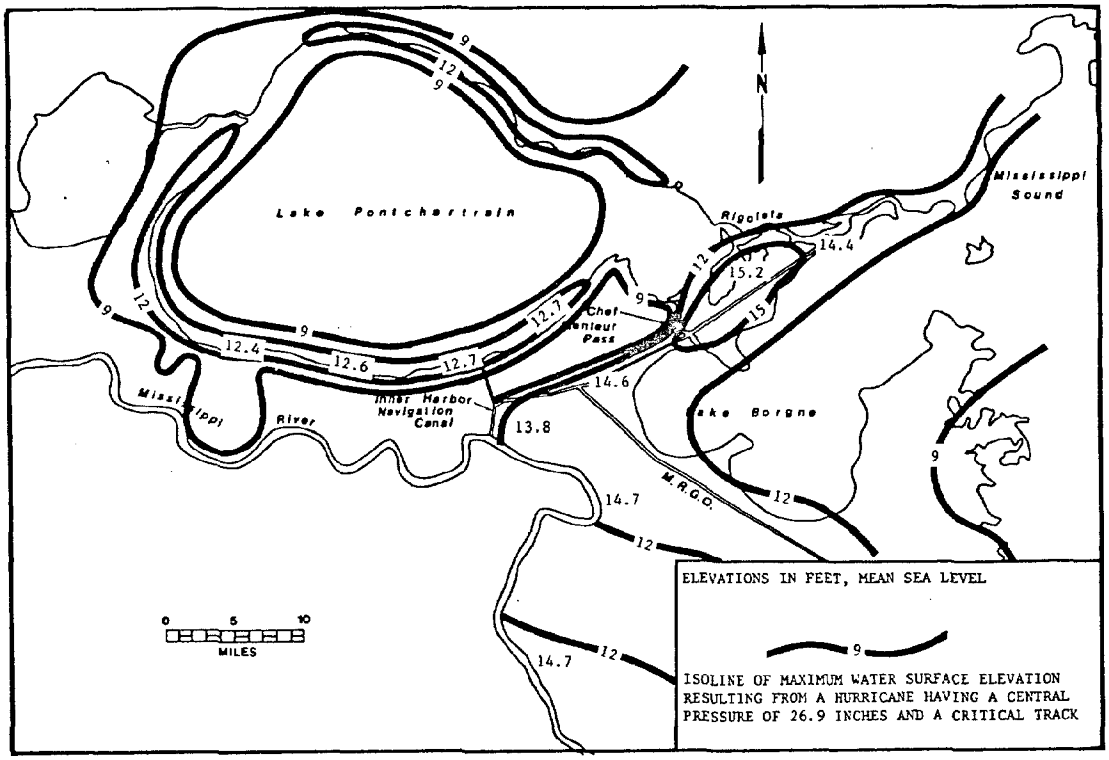

Figure A-8. Maximum surge contours predicted for Lake Pontchartrain and vicinity that might be generated by a "moderate project hurricane" (After USCE, 1962).

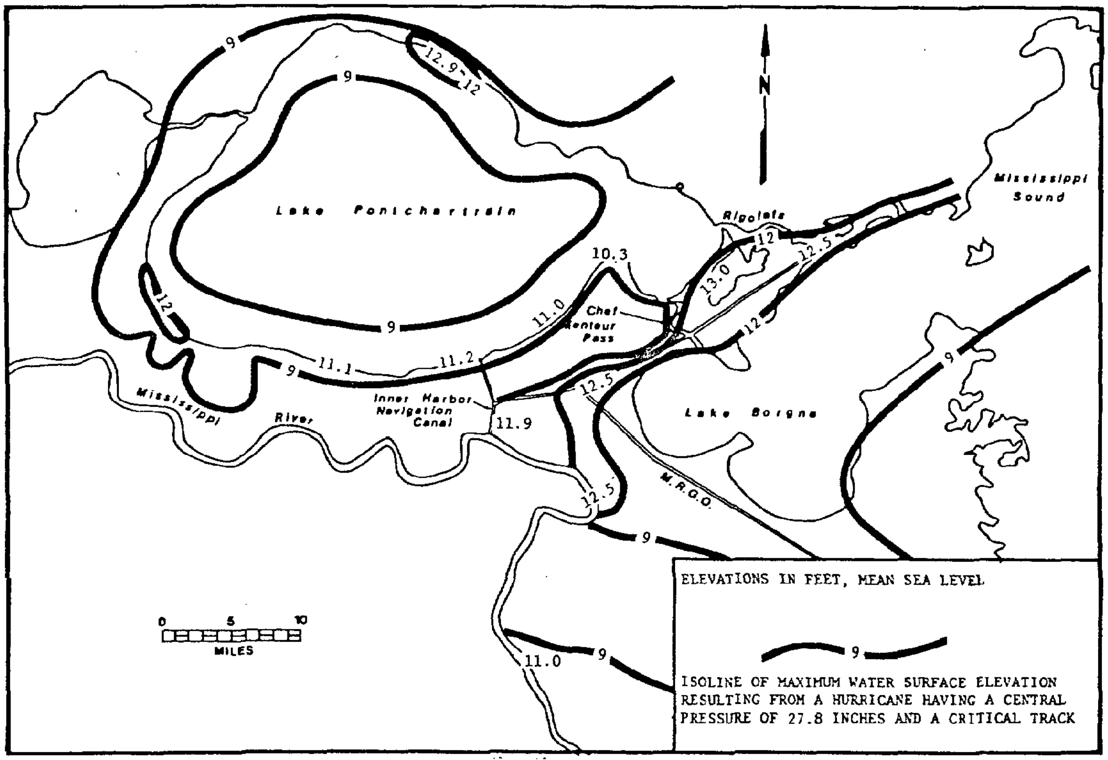

Figure A-9. Maximum surge contours predicted for Lake Pontchartrain and vicinity that might be generated by a "standard project hurricane" (After USCE, 1962).

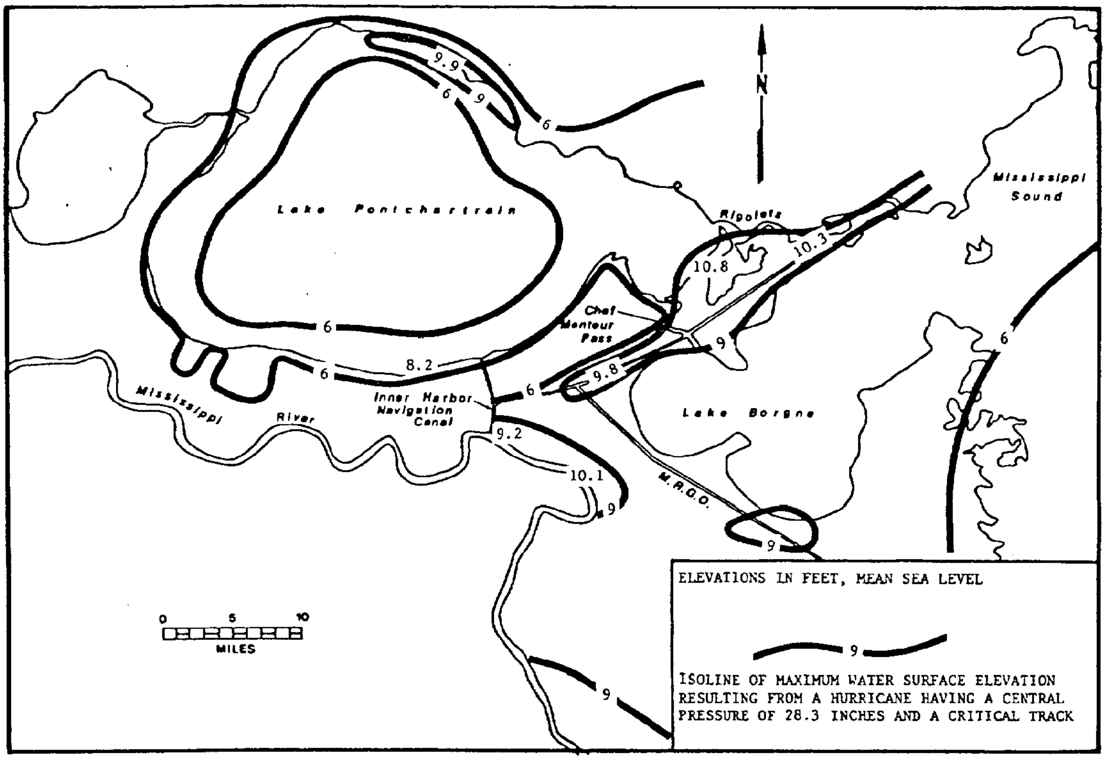

Figure A-10. Maximum surge contours predicted for Lake Pontchartrain and vicinity that might be generated by a "maximum project hurricane" (After USCE, 1962).

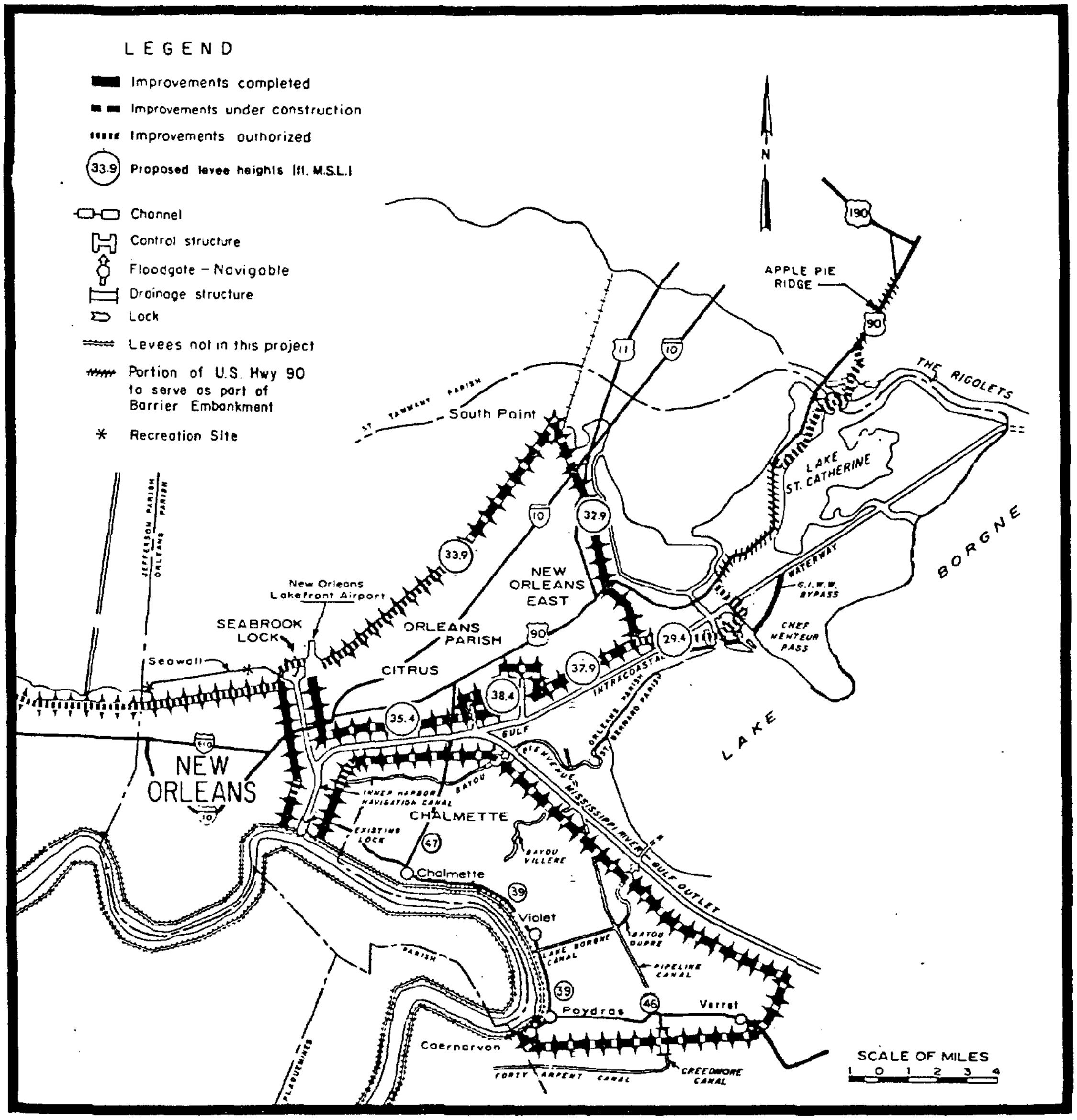

Figure A-11. Lake Pontchartrain, La., and vicinity hurricane protection plan (After USCE, 1975a; Pontchartrain Land Corp., 1972).

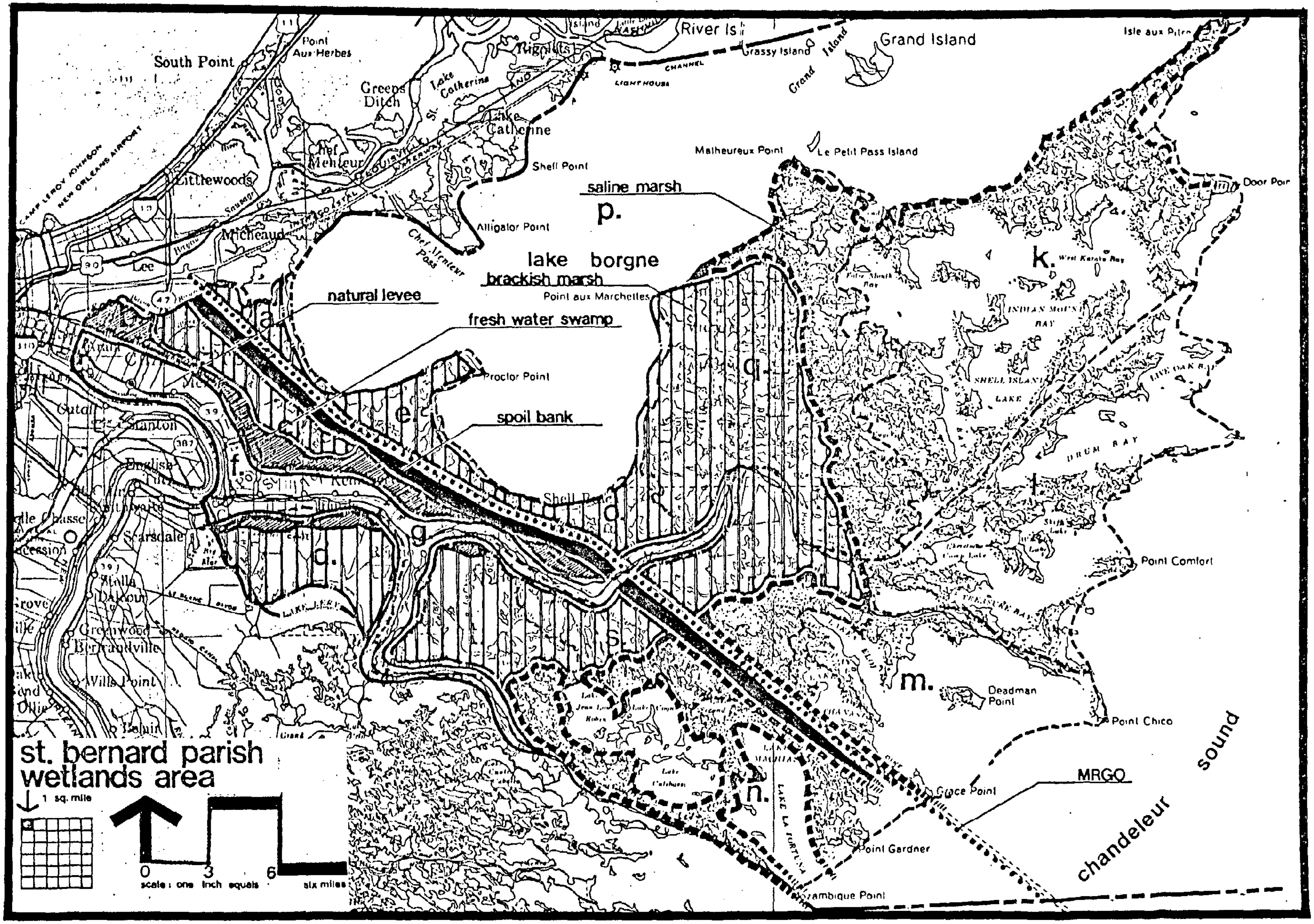

Figure A-12. Vegetation distribution, St. Bernard Parish, Louisiana.

Understory shrubbery on the natural levees is characterized by dwarf palmetto (Sabal minor), blackberry (Rubus spp.), hawthorns (Crataegus spp.), deciduous holly (Illex decidua), wax myrtle (Myrica cerifera), and grasses such as switch cane (Arundinaria tecta) and bermuda grass (Cynodon dactylon). Lower levees, which are subject to flooding, support only shrubs, grasses, and water tolerant trees.

A distinctive group of plants occurs in freshwater swamps flanking the backslopes of the natural levees. The original stands of cypress forest are mostly gone due to heavy logging which occurred around the turn of the century. The cypress forests which exist today vary considerably in condition; there are signs of deterioration due to subsidence and changes in the water regime. Typical species of trees found here are bald cypress (Taxodium distichum), swamp red maple (Acer rubrum drummondii), water oak (Quercus nigra), and tupelo gum (Nyssa aquatica). Typical understory vegetation includes dwarf palmetto (Sabal minor), button bush (Cephalanthus occidentalis), groundsel bush (Bacharies halimifolia), and swamp elder (Iva frutescens). Among the grasses, paille fine (Panicum hemitonium), sawgrass (Claidium jamaicense), feather grass (Panicum virgatum), and wiregrass (Spartina patens) are common.

Marsh areas cover most of the parish. The distribution of vegetation in the marshes is affected by salinity, elevation, and soil organic matter. The marshes in St. Bernard Parish are most commonly brackish or saline. These estuarine areas are covered with grasses and reeds, the principal sources of detritus and organic matter which are vital elements in the biological productivity of this area of the coast. In brackish marshes, the dominant type of grass is wiregrass (Spartina patens). Other types of grass, such as three-cornered grass (Scirpus olneyi), coco (Scirpus robustus), and saltgrass (Distichilis spicata), are also present. The predominant grass species in the salt marsh areas is oyster grass (Spartina alternifolia), followed by black rush (Juncus roemerianus) and saltgrass (Distichilis spicata). Less significant quantities exist of wiregrass (Spartina patens) and other grasses.

Spoil material has been deposited along the banks of man-made canals and natural channels that have been dredged. Spoil banks are higher than the elevation of the surrounding marsh. The vegetation found growing on the spoil is dependent upon the salinity of the water in the channel and the composition of the soils in the deposit. Typically, the vegetation will consist of wax myrtle (Myrica cerifera), groundsel tree (Baccharis halimifolia), willow (Salix sp.), marsh elder (Iva frutescens), and herbaceous perennials.

I. WILDLIFE HABITATS

1. General Wildlife Description

In general, the area represents a wetland-estuarine ecosystem important for its role in the early life stages of marine fishes and shellfishes. It is also an important habitat for migratory waterfowl and fur-bearing mammals. However, this wetland area has undergone considerable changes as a result of both natural and man-made processes, thus affecting to some extent the natural productivity of the area and its value as a wildlife habitat. At present, formerly fresh backswamp environments show evidence of saltwater intrusion with the presence of wiregrass growing in some areas beneath dead levees. The marshes beyond the swamplands are brackish, as determined by the type of grasses predominantly growing at present. Canals, bayous, and small tidal channels are connected with Lake Borgne and the Gulf of Mexico. Fish population in the lake is characterized by several fish species including spot (Leiostomus zanthurns), croaker (Micropogon undulatus), anchovy (Anchoa sp.), seatrout (Cynoscion sp.), hogchoker (Trinectes maculatus), menhaden (Brevoortia sp.), sea catfish (Galeichthyes felis), pinfish (Lagodon rhomboides), lined sole (Archirus lineatus), and silver perch (Bairdiella chrysura). Oysters (Crassostrea virginica), crustaceans such as shrimps (Penaeus spp.), and blue crabs (Callinectes sapidus) are also found in this environment. The majority of the identified fish and shellfish species in the area are estuarine dependent and require low salinity areas at some time or another in their life cycle.

Salinities in the study area marshes generally stayed below 10 ppt. Benthic invertebrates usually found in brackish waters are expected to inhabit bottom muds of channels and bayous in the study area. These organisms are important food for many fish species. The wetlands of the study area provide seasonal habitat for migratory waterfowl species. Ducks which may be expected seasonally in the area include American Coots (Fulica Americana), Mallards (Anas platyrhynchos), American Wigeons (Anas crecca), Pintails (Anas acuta), Blue-winged Teal (Anas discors), Gadwalls (Anas strepera), Mottled Ducks (Anas fulvigula); geese which may be expected are White-fronted Geese (Anser albifrous), Snow Geese (Chen caerulescens), and even Canada geese (Branta canadensis). Rails such as the King Rail (Rallus elegans), the Virginia Rail (Rallus limicola), the Sora (Porzana carolina), and the Snipe (Capella gallinago) may be found in the less saline marshes of the study area. Other birds which are found in this environment include wading birds such as Egrets and Herons, and marsh birds such as Redwinged Blackbirds, Boat-tailed Grackles, and Seaside Sparrows. Many songbirds use spoil bank vegetation as a habitat.

The marshes in the study area once supported large numbers of fur-bearing mammals, but environmental changes have brought a decline in population. If restored and properly managed, the area could again support a rich population of fur-bearers. The most common fur-bearers in this area are nutria (Myocastor coypus), muskrat (Onatra zibethicus), and racoons (Procyon lotor). Also found in the area, but less abundant, are the mink (Mustela vison) and otter (Lutra canadensis). Swamp rabbits (Sylvilagus aquaticus) are very common in these wetland habitats, and also in the spoil banks along channels and waterways.

a) Rare and endangered species

Some of the endangered species which inhabit or pass through St. Bernard Parish are the Eastern Brown Pelican (Pelecanus occidentalis) and the Peregrine Falcon (Falcon peregrinus). The American alligator (Alligator mississippiensis) is no longer on the list of endangered species but is now on the list of threatened species.

J. FARMLANDS

Agriculture, which used to be one of the economic bases of the parish, has undergone great changes, and the number of farms has been decreasing in the last two decades. Table A-4 illustrates some of these changes for this period of time. Truck farming, livestock, and a few dairy farms

Table A-4. Farms, Land in Farms, and Land Use: 1969 and 1964

		1969	1964
All Farms			
All farms	number	27	33
Land in Farms	acres	7,112	15,152
Average size of farm	acres	263.4	459.2
Approximate land area	acres	329,024	326,405
Proportion in farms	percent	2.2	4.6
Value of land and buildings	dollars	2,052,900	(NA)*
Average per farm	dollars	76,033	78,273
Average per acre	dollars	288.65	175.11
Land in Farms According to Use			
Total Cropland	farms	21	29
	acres	651	2,032
Harvested cropland	farms	18	27
	acres	354	377
Number of farms by acres harvested			
1 to 9 acres		8	13
10 to 19 acres		4	6
20 to 29 acres		3	3
30 to 49 acres		1	5
50 to 99 acres		1	—
100 to 199 acres		1	—
200 to 499 acres		—	—
500 to 999 acres		—	—
1000 acres and over		—	—
Cropland used only for pasture or grazing	farms	7	7
	acres	164	1,387
All other cropland	farms	4	(NA)*
	acres	133	268
Woodland including woodland pasture	farms	11	16
	acres	253	3,314
All other land	farms	17	(NA)*
	acres	6,208	9,804
Irrigated land	farms	2	1
	acres	3	20

*(NA) - not available

Source: Department of Commerce, 1973

are still in operation, but their economic influence in the parish has decreased as much as the number of farms still operating.

K. RECREATIONAL ELEMENTS

Because of its location, the area has tremendous recreational potential, especially with regard to water-based activities such as fishing, boating, crawfishing, etc. There are also many opportunities for primitive camping, hunting, and nature study. Several bayous or segments of bayous within this area are scenic rivers, including the Violet Canal, Bayou Dupre, Bashman Bayou, Terre Beau Bayou, Pirogue Bayou, Bayou Bienvenue, and Bayou Chaperon.

The area is rich in historical and cultural resources. The Biloxi Wildlife Management Area (16,089 hectares [39,728 acres]) offers recreational opportunities for fishing and hunting according to seasonal schedule, and for nature study (Figure A-13). The Breton National Wildlife Refuge within St. Bernard and Plaquemine Parishes offers 3,042 hectares (7,512 acres) of island environments. A national park, the Chalmette National Historic Park, is located several kilometers from the study area at Violet. St. Bernard State Park, located within the batture land south of English Turn, is in the process of being completed. This park has been designed as a resource-oriented park offering a variety of recreational facilities.

1. Supply and Demand for Recreational Resources

Projected participation of the population for various activities for the years 1980, 1985, 1990 and 1995 is depicted in Table A-5.

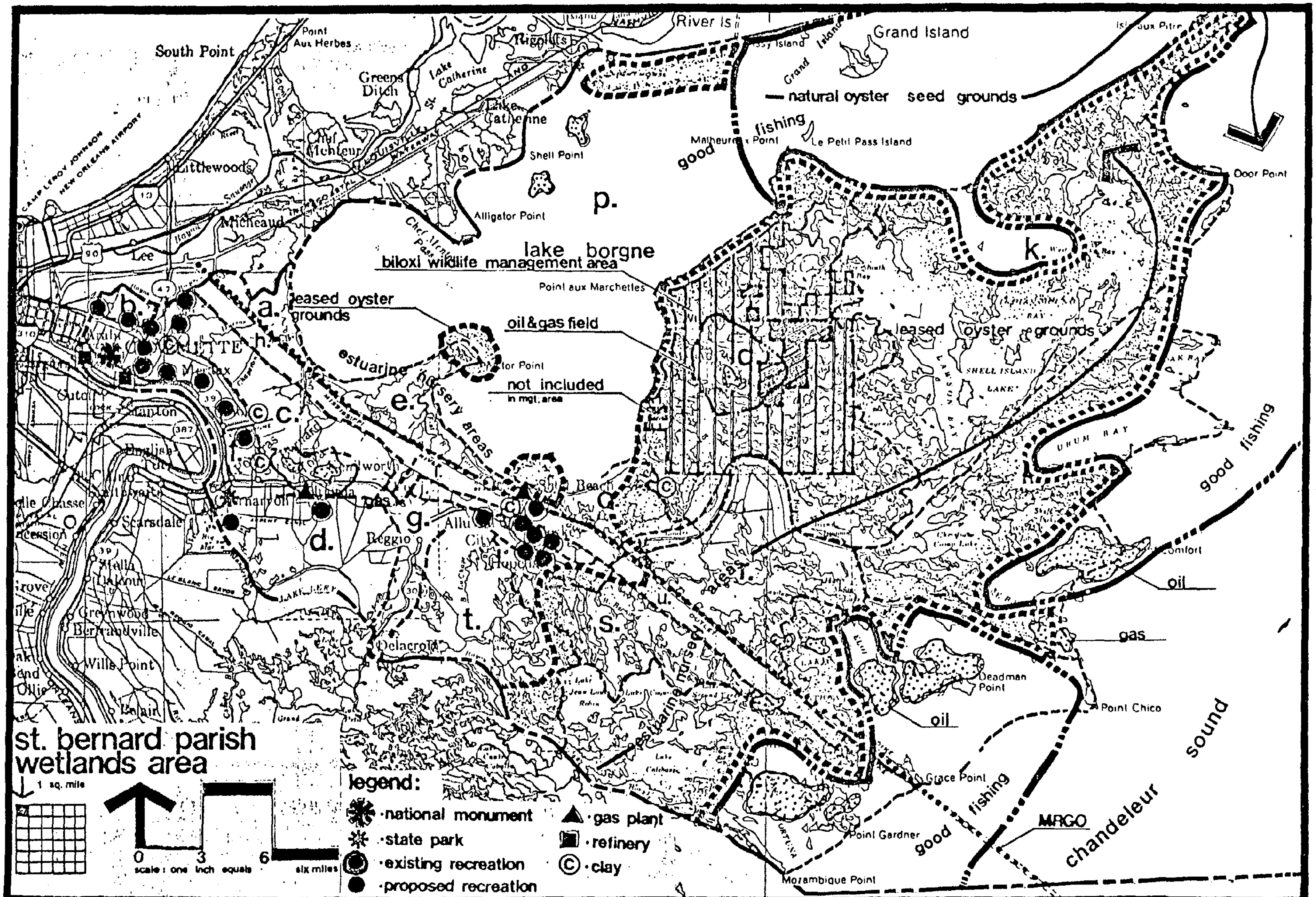

Figure A-13. Recreation and principal resources, St. Bernard Parish, Louisiana.

Table A-5. Louisiana State Comprehensive Outdoor Recreation Plan.

REGION 1 NEEDS CALCULATIONS FOR 1980
BASED ON A PROJECTED POPULATION OF 1,199,950[1]

ACTIVITY	PARTICIPATION RATE[2]	HIGH QUARTER USER DAY PARTICIPATION	HIGH QUARTER SUNDAY PARTICIPATION AT 2.88%	STANDARD[3]	PROJECTED PARTICIPATION	EXISTING SUPPLY[4]	FACILTIY NEEDS[5]
Birdwatching	1.60	1,919,930	55,294	---	---	---	---
Bicycling	11.34	13,607,501	391,896	---	---	---	---
Camping, tent	.76	911,967	26,265	.036A	946	215	731
Camping, trailer	.55	659,976	19,007	.025A	475	491	(16)
Canoeing	.39	467,983	13,478	.16M	2,156	329	1,827
Crawfishing	2.01	2,411,912	69,463	---	---	---	---
Crabbing	3.07	3,683,865	106,095	---	---	---	---
Driving for pleasure	9.74	11,687,571	336,602	---	---	---	---
Fishing, freshwater	2.56	3,071,887	88,470	.012A	1,062	28	1,034
Fishing, saltwater	3.39	4,067,851	117,154	.012A	1,406	28	1,378
Golfing	1.65	1,979,927	57,022	.14A	7,983	1508	6,475
Hiking	.76	911,967	26,265	.03M	788	8	780
Horseback riding	.96	1,151,958	33,176	.05M	1,659	13	1,646
Hunting big game	.55	659,976	19,007	26A	494,190	119,302	374,888
Hunting small game	1.10	1,319,952	38,015	---	---	---	---
Hunting waterfowl	1.00	1,199,956	34,559	---	---	---	---
Motor boating	3.57	4,283,843	123,375	.008A	987	28	959
Motorcycling	1.72	2,063,924	59,441	---	---	---	---
Nature walk	3.22	3,863,858	111,279	.025M	2,787	13	2,769
Picnicking	3.80	4,559,833	131,323	.02A	2,626	754	1,872
Playing baseball	4.25	5,099,813	146,875	.025A	3,672	388	3,284
Playing basketball	2.77	3,323,878	95,728	.0025A	239	21.3	217.
Playing football	3.83	4,595,831	132,360	.033A	4,368	258	4,110
Playing volleyball	2.90	3,479,872	100,220	---	---	---	---
Sailing	.81	971,964	27,993	---	---	---	---
Sightseeing	4.76	5,711,791	164,500	---	---	---	---
Swimming, gulf	1.86	2,231,918	64,279	110.87SF	7,126,639	1,128,240	5,998,399
Swimming, lakes	1.99	2,387,912	68,772	---	---	---	---
Swimming, pools	10.10	12,119,556	349,043	4.48SF	1,563,713	214,668	1,349,045
Tennis	2.33	2,795,897	80,522	.002A	161	10.2	150.
Walking	9.49	11,387,582	327,962	---	---	---	---
Watching auto racing	.64	767,971	22,118	---	---	---	---
Watching baseball	4.54	5,447,800	156,897	---	---	---	---
Watching football	5.22	6,263,770	180,397	---	---	---	---
Watching golf	.42	503,982	14,515	---	---	---	---
Watching horse racing	1.38	1,655,939	47,691	---	---	---	---
Watching outdoor concerts	.80	959,965	27,647	---	---	---	---
Watching tennis	.70	839,969	24,191	---	---	---	---
Water skiing	1.23	1,475,946	42,507	.008A	340	28	312

[1]Harris Segal, Gordon Saussy, Fred Wrighton, Don Wilcox, and Roger Burford, Projections to the Year 2000 of Louisiana Population and Households (New Orleans, 1976)
[2]Participation rates for Region 1 are a weighted average of the participation rates for Regions 1A and 1B as determined in the Participation survey detailed on pages . The weighting factor used was 1975 populations of the two regions.
[3]A=Acres, M=Mile(s), SF=Square Feet
[4]Source: LaSPARC inventory.
[5]Needs calculation formula: (participation rate)(population)=(high quarter user day participation)(2.88%)=(high quarter Sunday participation) (standard)=projected participation. Projected participation — existing supply = need.

Table A-5 (Continued).

REGION 1 NEEDS CALCULATION FOR 1985
BASED ON A PROJECTED POPULATION OF 1,281,661[1]

ACTIVITY	PARTICIPATION RATE[2]	HIGH QUARTER USER DAY PARTICIPATION	HIGH QUARTER SUNDAY PARTICIPATION AT 2.88%	STANDARD[3]	PROJECTED PARTICIPATION	EXISTING SUPPLY[4]	FACILTIY NEEDS[5]
Birdwatching	1.60	2,050,658	59,059	---	---	---	---
Bicycling	11.34	14,534,036	418,580	---	---	---	---
Camping, tent	.76	974,062	28,053	.036A	1,010	215	795
Camping, trailer	.55	704,914	20,302	.025A	508	491	17
Canoeing	.39	499,848	14,396	.16M	2,303	329	1,974
Crawfishing	2.01	2,576,139	74,193	---	---	---	---
Crabbing	3.07	3,934,699	113,319	---	---	---	---
Driving for pleasure	9.74	12,483,378	359,521	---	---	---	---
Fishing, freshwater	2.56	3,281,052	94,494	.012A	1,134	28	1,106
Fishing, saltwater	3.39	4,344,831	125,131	.012A	1,502	28	1,474
Golfing	1.65	2,114,741	60,905	.14A	8,527	1508	7,019
Hiking	.76	974,062	28,053	.03M	842	8	834
Horseback riding	.96	1,230,395	35,435	.05M	1,772	13	1,759
Hunting big game	.55	704,914	20,302	26A	527,839	119,302	408,537
Hunting small game	1.10	1,409,827	40,603	---	---	---	---
Hunting waterfowl	1.00	1,281,661	36,912	---	---	---	---
Motor boating	3.57	4,575,530	131,775	.008A	1,054	28	1,026
Motorcycling	1.72	2,204,457	63,488	---	---	---	---
Nature walk	3.22	4,126,948	118,856	.025M	2,971	13	2,958
Picnicking	3.80	4,870,312	140,265	.02A	2,805	754	2,051
Playing baseball	4.25	5,447,059	156,875	.025A	3,922	388	3,534
Playing basketball	2.77	3,550,201	102,246	.0025A	256	21.3	234.
Playing football	3.83	4,908,762	141,362	.033A	4,665	258	4,407
Playing volleyball	2.90	3,716,817	107,044	---	---	---	---
Sailing	.81	1,038,145	29,889	---	---	---	---
Sightseeing	4.76	6,100,706	175,700	---	---	---	---
Swimming, gulf	1.86	2,383,889	68,656	110.87SF	7,611,892	1,128,240	6,483,651
Swimming, lakes	1.99	2,550,505	73,455	---	---	---	---
Swimming, pools	10.10	12,944,776	372,810	4.48SF	1,670,187	214,668	1,455,519
Tennis	2.33	2,986,270	86,005	.002A	172	10.2	161.
Walking	9.49	12,162,963	350,293	---	---	---	---
Watching auto racing	.64	820,263	23,624	---	---	---	---
Watching baseball	4.54	5,818,741	167,580	---	---	---	---
Watching football	5.22	6,690,270	192,680	---	---	---	---
Watching golf	.42	538,298	15,503	---	---	---	---
Watching horse racing	1.38	1,768,692	50,938	---	---	---	---
Watching outdoor concerts	.80	1,025,329	29,529	---	---	---	---
Watching tennis	.70	897,163	25,838	---	---	---	---
Water skiing	1.23	1,576,443	45,402	.008A	363	28	335

[1]Harris Segal, Gordon Saussy, Fred Wrighton, Don Wilcox, and Roger Burford, Projections to the Year 2000 of Louisiana Populatio and Households (New Orleans, 1976)
[2]Participation rates for Region 1 are a weighted average of the participation rates for Regions 1A and 1B as determined in the Participation survey detailed on pages . The weighting factor used was 1975 populations of the two regions.
[3]A=Acres, M=Mile(s), SF=Square Feet
[4]Source: LaSPARC inventory.
[5]Needs calculation formula: (participation rate)(population)=(high quarter user day participation)(2.88%)=(high quarter Sunday participation) (standard)=projected participation. Projected participation — existing supply = need.

Table A-5 (Continued).

REGION 1 NEEDS CALCULATION FOR 1990
BASED ON A PROJECTED POPULATION OF 1,358,313 [1]

ACTIVITY	PARTICIPATION RATE[2]	HIGH QUARTER USER DAY PARTICIPATION	HIGH QUARTER SUNDAY PARTICIPATION AT 2.88%	STANDARD[3]	PROJECTED PARTICIPATION	EXISTING SUPPLY[4]	FACILTIY NEEDS[5]
Birdwatching	1.60	2,173,301	62,591	---	---	---	---
Bicycling	11.34	15,403,269	443,614	---	---	---	---
Camping, tent	.76	1,032,318	29,731	.036A	1,070	215	885
Camping, trailer	.55	747,072	21,516	.025A	538	491	47
Canoeing	.39	529,742	15,257	.16M	2,441	329	2,112
Crawfishing	2.01	2,730,209	78,630	---	---	---	---
Crabbing	3.07	4,170,021	120,097	---	---	---	---
Driving for pleasure	9.74	13,229,969	381,023	---	---	---	---
Fishing, freshwater	2.56	3,477,281	100.146	.012A	1,202	28	1,174
Fishing, saltwater	3.39	4,604,681	132,615	.012A	1,591	28	1,563
Golfing	1.65	2,241,216	64,547	.14A	9,037	1508	7,529
Hiking	.76	1,032,318	29,731	.03M	892	8	884
Horseback riding	.96	1,303,980	37,555	.05M	1,878	13	1,865
Hunting big game	.55	747,042	21,516	26A	559,407	119,302	440,105
Hunting small game	1.10	1,494,144	43,031	---	---	---	---
Hunting waterfowl	1.00	1,358,313	39,119	---	---	---	---
Motor boating	3.57	4,849,177	139,656	.008A	1,117	28	1,089
Motorcycling	1.72	2,336,298	67,285	---	---	---	---
Nature walk	3.22	4,373,767	125,964	.025M	3,149	13	3,136
Picnicking	3.80	5,161,589	148,654	.02A	2,973	754	2,219
Playing baseball	4.25	5,772,830	166,258	.025A	4,156	388	3,768
Playing basketball	2.77	3,762,527	108,361	.0025A	271	21.3	249
Playing football	3.83	5,202,339	149,827	.033A	4,944	258	4,686
Playing volleyball	2.90	3,939,108	113,446	---	---	---	---
Sailing	.81	1,100,234	31,687	---	---	---	---
Sightseeing	4.76	6,465,570	186,208	---	---	---	---
Swimming, gulf	1.86	2,526,462	72,762	110.87SF	8,067,135	1,128,240	6,938,895
Swimming, lakes	1.99	2,703,043	77,848	---	---	---	---
Swimming, pools	10.10	13,718,961	395,106	4.48SF	1,770,075	214,668	1,555,407
Tennis	2.33	3,164,869	91,148	.002A	182	10.2	171
Walking	9.49	12,890,390	371,243	---	---	---	---
Watching auto racing	.64	869,320	25,036	---	---	---	---
Watching baseball	4.54	6,166,741	177,602	---	---	---	---
Watching football	5.22	7,090,394	204,203	---	---	---	---
Watching golf	.42	570,491	16,430	---	---	---	---
Watching horse racing	1.38	1,874,472	53,985	---	---	---	---
Watching outdoor concerts	.80	1,086,650	31,296	---	---	---	---
Watching tennis	.70	950,819	27,384	---	---	---	---
Water skiing	1.23	1,670,725	48,117	.008A	385	28	357

[1]Harris Segal, Gordon Saussy, Fred Wrighton, Don Wilcox, and Roger Burford, Projections to the Year 2000 of Louisiana Populatio and Households (New Orleans, 1976)
[2]Participation rates for Region 1 are a weighted average of the participation rates for Regions 1A and 1B as determined in the Participation survey detailed on pages . The weighting factor used was 1975 populations of the two regions.
[3]A=Acres, M-Mile(s), SF=Square Feet
[4]Source: LaSPARC inventory.
[5]Needs calculation formula: (participation rate)(population)=(high quarter user day participation)(2.88%)=(high quarter Sunday participation)(standard)=projected participation. Projected participation — existing supply = need.

Table A-5 (Continued).

REGION 1 NEEDS CALCULATION FOR 1995 BASED ON A PROJECTED POPULATION OF 1,430,622[1]

ACTIVITY	PARTICIPATION RATE[2]	HIGH QUARTER USER DAY PARTICIPATION	HIGH QUARTER SUNDAY PARTICIPATION AT 2.88%	STANDARD[3]	PROJECTED PARTICIPATION	EXISTING SUPPLY[4]	FACILTIY NEEDS[5]
Birdwatching	1.60	2,288,995	65,923	---	---	---	---
Bicycling	11.34	16,223,253	467,230	---	---	---	---
Camping, tent	.76	1,087,273	31,313	.036A	1,127	215	912.
Camping, trailer	.55	786,842	22,661	.025A	567	491	76
Canoeing	.39	557,943	16,069	.16M	2,571	329	2,242
Crawfishing	2.01	2,875,550	82,816	---	---	---	---
Crabbing	3.07	4,392,010	126,490	---	---	---	---
Driving for pleasure	9.74	13,934,258	401,307	---	---	---	---
Fishing, freshwater	2.56	3,662,392	105,477	.012A	1,266	28	1,238
Fishing, saltwater	3.39	4,849,809	139,674	.012A	1,676	28	1,648
Golfing	1.65	2,360,526	67,983	.14A	9,518	1508	8,010
Hiking	.76	1,087,273	31,313	.03M	939	8	931
Horseback riding	.96	1,373,397	39,554	.05M	1,978	13	1,965
Hunting big game	.55	786,842	22,661	26A	589,186	119,302	469,884
Hunting small game	1.10	1,573,684	45,322	---	---	---	---
Hunting waterfowl	1.00	1,430,622	41,202	---	---	---	---
Motor boating	3.57	5,107,321	147,091	.008A	1,177	28	1,149
Motorcycling	1.72	2,460,670	70,867	---	---	---	---
Nature walk	3.22	4,606,603	132,670	.025M	3,317	13	3,304
Picnicking	3.80	5,436,364	156,567	.02A	3,131	754	2,377
Playing baseball	4.25	6,080,144	175,108	.025A	4,378	388	3,990
Playing basketball	2.77	3,962,823	114,129	.0025A	285	21.3	263
Playing football	3.83	5,479,282	157,803	.033A	5,208	258	4,950
Playing volleyball	2.90	4,148,804	119,486	---	---	---	---
Sailing	.81	1,158,804	33,374	---	---	---	---
Sightseeing	4.76	6,809,761	196,121	---	---	---	---
Swimming, gulf	1.86	2,660,957	76,636	110.87SF	8,496,533	1,128,240	7,368,343
Swimming, lakes	1.99	2,846,938	81,992	---	---	---	---
Swimming, pools	10.10	14,449,282	416,139	4.48SF	1,864,304	214,668	1,649,636
Tennis	2.33	3,333,349	96,000	.002A	192	10.2	181
Walking	9.49	13,576 603	391,006	---	---	---	---
Watching auto racing	.64	915,598	26,369	---	---	---	---
Watching baseball	4.54	6,495,024	186,057	---	---	---	---
Watching football	5.22	7,467,847	215,074	---	---	---	---
Watching golf	.42	600,861	17,305	---	---	---	---
Watching horse racing	1.38	1,974,258	56,859	---	---	---	---
Watching outdoor concerts	.80	1,144,498	32,962	---	---	---	---
Watching tennis	.70	1,001,435	28,841	---	---	---	---
Water skiing	1.23	1,759,665	50,678	.008A	405	28	377

[1] Harris Segal, Gordon Saussy, Fred Wrighton, Don Wilcox, and Roger Burford, Projections to the Year 2000 of Louisiana Population and Households (New Orleans, 1976)

[2] Participation rates for Region 1 are a weighted average of the participation rates for Regions 1A and 1B as determined in the Participation survey detailed on pages . The weighting factor used was 1975 populations of the two regions.

[3] A=Acres, M=Mile(s), SF=Square Feet

[4] Source: LaSPARC inventory.

[5] Needs calculation formula: (participation rate)(population)=(high quarter user day participation)(2.88%)=(high quarter Sunday participation)(standard)=projected participation. Projected participation — existing supply = need.

Source: Department of Culture, Recreation, and Tourism, 1977.

There are a number of playgrounds and playfields in St. Bernard Parish which offer facilities, such as baseball diamonds, football fields, basketball courts, and others; some of which are part of the St. Bernard Parish Police Jury Recreation Department. A number of public and private boat slips, ramps, and marinas are located throughout the parish, such as those at Poydras, Yscloskey, and Lake Borgne Canal near Violet. Outdoor recreational facilities, such as the one at Shell Beach, Lake Borgne, and other surrounding sites, are depicted in Figure A-13.

SECTION B: NOISE IMPACTS

The proposed wetlands management program is not a noise sensitive project, however, construction activities of some of the structural measures will generate some noise. No sensitive receptors are presently found in the wetlands area. The project is not in an unacceptable noise zone as defined by HUD Circular 1390.2 (U.S. Department of the Interior, 1975).

It is not likely that noise generated by construction activities would exceed noise criteria established by the U.S. Department of the Interior in 1975 for recreational areas (45 dBA daytime, 40 dBA evening, 30 dBA night). Therefore, it is not considered that outdoor recreation in the wetlands area would be adversely affected by noise pollution.

The general effect of noise on terrestrial wildlife (including birds) is likely to be one of the wildlife's temporary avoidance of the construction area.

SECTION C: AIR QUALITY

The wetlands of St. Bernard Parish have a high air quality and have no history of air pollution. Because of the area's setting on the coast, there is almost continuous air movement, indicating that any potential pollutants would be rapidly dispersed. Low atmospheric stability and limited atmospheric inversion prevailing in the area further contribute to favorable atmospheric conditions.

Measurements of atmospheric stability at Taft, Louisiana (80 km [50 mi] inland from the coast) during May 1972 through April 1973 showed extremely stable conditions during 26% of the year and neutral to slightly stable conditions during 60% of the year (Louisiana Power and Light Co., 1974). Atmospheric inversion in the area has an average annual frequency of about 23% of total hours (Hosler, 1961). Inversion frequency ranges from 35% in the winter to 20% in the summer.

Construction and maintenance of some of the structural measures would probably temporarily affect air quality. Emissions and dust particles from equipment will be released into the air. However, it is not anticipated that these sources would greatly change air quality or have major adverse effects on ambient air quality levels.

SECTION D: WATER QUALITY

A. STATE WATER QUALITY STANDARDS

The Louisiana Stream Control Commission sets standards for water quality in the State of Louisiana. The Commission sets general standards applicable to the surface waters of the state and numerical criteria for specific streams. The state's general water quality criteria are listed below:

1) Aesthetics - the waters of the state shall be maintained in an esthetically attractive condition and shall meet the generally accepted aesthetic qualifications. All waters shall be free from such concentrations of substances attributable to wastewater or other discharges sufficient to:

   a) settle to form objectionable deposits;

   b) float as debris, scum, oil, or other matter to form nuisances;

   c) result in objectionable color, odor, taste, or turbidity;

   d) injure or are toxic or produce adverse physiological response in humans, animals, fish, shellfish, wildlife, or plants; and

   e) produce undesirable or nuisance aquatic life.

2) Color - true color shall not be increased to the extent that it will interfere with present usage and projected future usage of the streams and water bodies.

   a) waters shall be virtually free from objectionable color;

   b) the source of supply should not exceed 75 color units on the platinun-cobalt scale for domestic water supplies; and

   c) increased color (in combination with turbidity) shall not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

3) Floating, suspended, and settleable solids- there shall be no substances present in concentration sufficient to produce distinctly visible turbidity, solids or scum; nor shall there be any formation of slimes, bottom deposits, or sludge banks

attributable to waste discharges from municipal, industrial, or other sources, including agricultural practices. Settleable and suspended solids shall not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life.

4) Taste and odor - taste- and odor-producing substances shall be limited to concentrations in the waters of the state that will not interfere with the production of potable water by reasonable water treatment methods, or impart unpalatable flavor to food fish, including shellfish, or result in offensive odors arising from the waters, or otherwise interfere with the reasonable use of the waters.

5) Toxic substances - shall not be present in quantities that alone or in combination will be toxic to animal or plant life. In all cases the level shall not exceed the TLM 96/10. Bioassay techniques will be used in evaluating toxicity utilizing methods and species of test organisms suitable to the purpose at hand. In cases where the stream is used as a public water supply, the level of toxic substances shall not exceed the levels established by the United States Public Health Service drinking water standards latest edition.

6) Oils and greases - there shall be no free or floating oil or grease present in sufficient quantities to interfere with the designated uses, nor shall emulsified oils be present in sufficient quantities to interfere with the designated uses.

7) Foaming and frothing materials - none of a persistent nature.

8) Nutrients - the naturally occurring nitrogen-phosphorous ratio shall be maintained. On completion of detailed studies on the naturally occurring levels of the various macro and micro nutrients, the state will establish numerical limits on nutrients where possible.

Water bodies within St. Bernard Parish for which the Louisiana Stream Control Commission (1977) has established standards are listed in Table D-1. The U.S. Environmental Protection Agency has established standards for many polluting substances. The EPA's water quality standards for heavy metals are shown in Table D-2.

B. PRESENT CONDITIONS

The presence of large areas of dead cypress trees indicate that at one time sections of the wetlands of St. Bernard Parish had a water regime

Table D-1. Louisiana Stream Control Commission Water Quality Standards.

Segment Description	Water Uses: 1. primary contact - swimming, skiing 2. secondary contact - fishing, wading, etc. 3. propagation of fish and wildlife	1. secondary contact 2. propagation of fish and wildlife	1. secondary contact 2. propagation of fish and wildlife 3. domestic raw water supply	Dissolved oxygen 4 mg/l	5 mg/l	CL mg/l	SO_4 mg/l	Temp. °C	pH	Bacteria standard - coliforms/100 ml
Bay Boudreau (tidal)		X			X			35	6.5-9.0	total - 70 and not more than 10% of the samples greater than 230
Bayou La Loutre (tidal) Hopeville to Chandelier Sound	X			X				35	6.5-9.0	"
Bayou Terre aux Bouefs (tidal)		X		X				35	6.5-9.0	"
Eloi Bay (tidal)		X			X			35	6.5-9.0	"
Lake St. Catherine (tidal)		X		X				35	6.5-9.0	"
Lake Borgne (tidal)	X				X			35	6.5-9.0	"
Lake Fortuna (tidal)		X			X			35	6.5-9.0	"
Lake Lery (tidal)		X		X				35	6.5-9.0	"
Morgan Harbor (tidal)		X			X			35	6.5-9.0	"
Chandelier Sound (tidal)	X				X			35	6.5-9.0	"
Mississippi River - Huey Long Bridge to Head of Passes			X		X	75	120	32	6.5-9.0	total - 10,000 fecal - 2,000

Source: Louisiana Stream Control Commission, 1977.

Table D-2. Environmental Protection Agency Water Quality Standards for Heavy Metals.

Metal	Fresh water and marine aquatic life	Irrigation of Crops	Domestic Water Supply
Cn	5.0		
As		100.0	50.0
Cd	.4 - 12.0*		10.0
Cr	100.0		50.0
Cu	.1 times a 96 hour LC_{50} ** as determined through a nonaerated bioassay using a sensitive aquatic resident species		1.0
Pb	.01 times the 96 hour LC_{50}		50.0
Hg	.10 (marine) .05 (fresh)		2.0
Ni	.01 times the 96 hour LC_{50} for freshwater and marine aquatic life		
Zn	.01 of the 96 hour LC_{50} as determined through a bioassay using a sensitive resident species		5,000.0

* varies with the hardness of the water
** lethal concentration for ½ of the test organisms

Source: Environmental Protection Agency, 1976.

dominated by fresh water. Today nearly all wetlands outside the hurricane levees contain brackish waters. Figure A-6, Section A illustrates water salinity variations within the parish.

Although some of the increase in water salinity in the parish wetlands is, no doubt, the result of natural subsidence and erosion, much of the increase can be attributed to the construction of canals, especially large ones such as the Mississippi River Gulf Outlet. The effect of the Mississippi River Gulf Outlet on water salinities in St. Bernard Parish is illustrated in Figures D-1 and D-2. Both figures demonstrate the increase in salinities after the construction of the MRGO. This increase results from the saltwater wedge which moves up the MRGO from the Gulf of Mexico. Figure D-3 shows vertical salinity profiles in the MRGO and demonstrates the movement of saltwater up the MRGO during the low fresh water runoff period.

Water pollution is a problem in certain parts of the parish, especially in the Mississippi River. Concentrations of coliform organisms, heavy metals, and other pollutants are very high during certain periods. Table D-3 shows the average monthly count of total coliforms for the Mississippi River at Violet. The table demonstrates that organic pollution of the river is much higher during the low water months. Organic pollution data for the parish wetlands are given in Table D-4. Figure D-4 shows the location of the sampling stations. Although at certain times coliform counts in the wetlands exceed state limits for shellfish propagation, they are generally much lower than counts for the Mississippi River, and are closely monitored by the Louisiana State Department of Health and Human Resources.

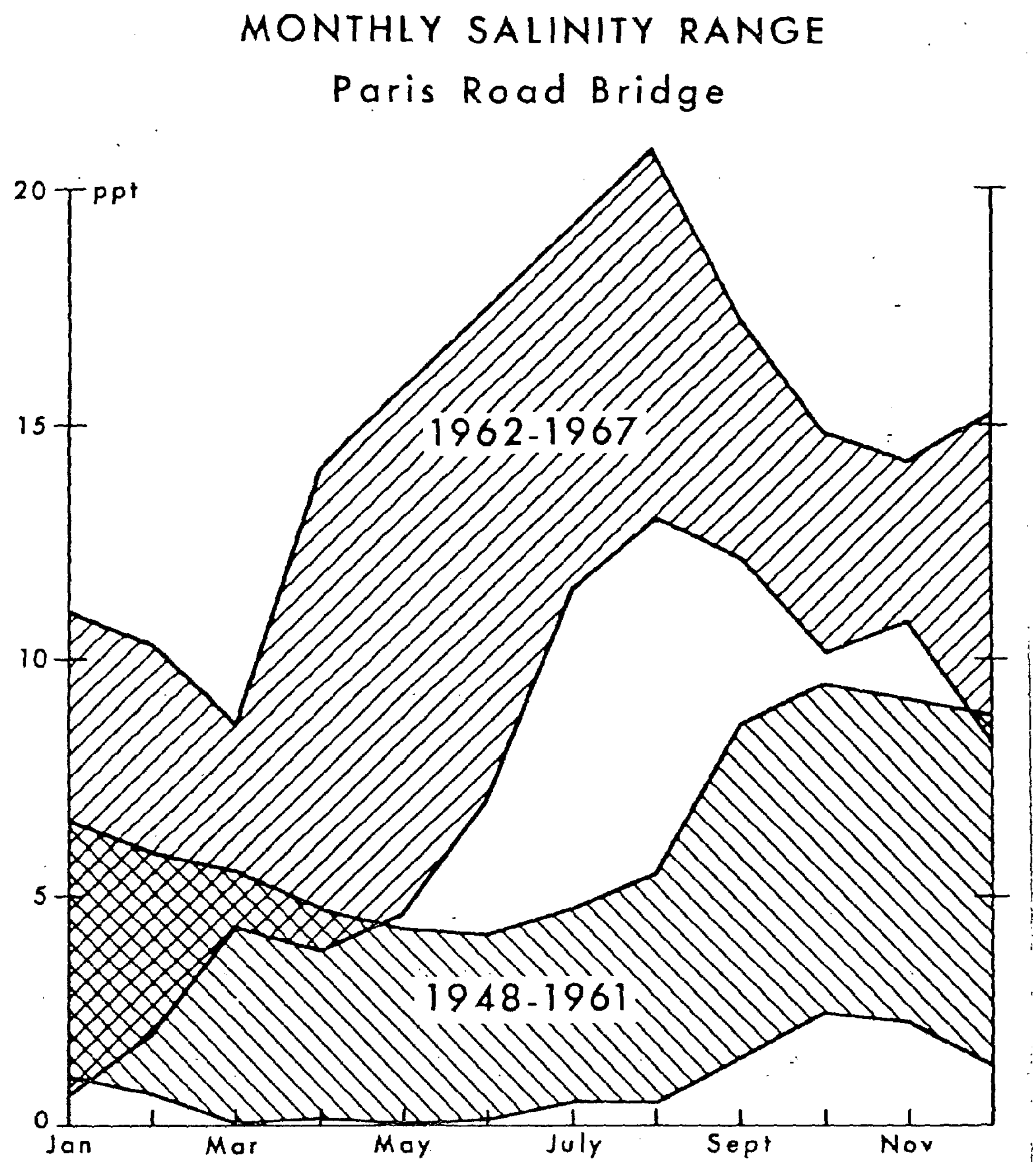

Figure D-1. Comparison of monthly salinity ranges at Paris Road Bridge for periods before and after construction of the MRGO. (After USCE unpublished data).

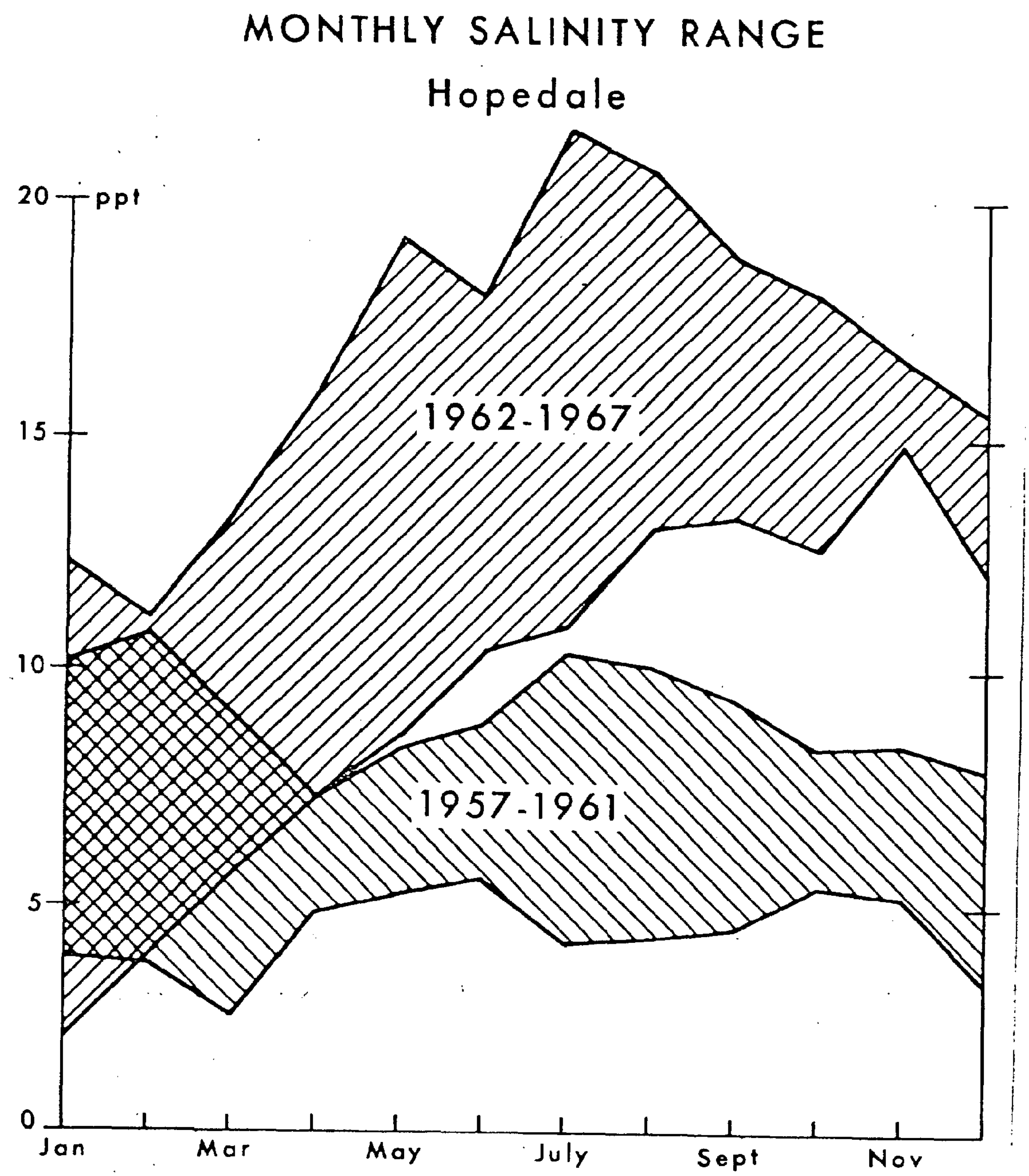

Figure D-2. Comparison of monthly salinity ranges at Hopedale for periods before and after construction of the MRGO (After USCE unpublished data).

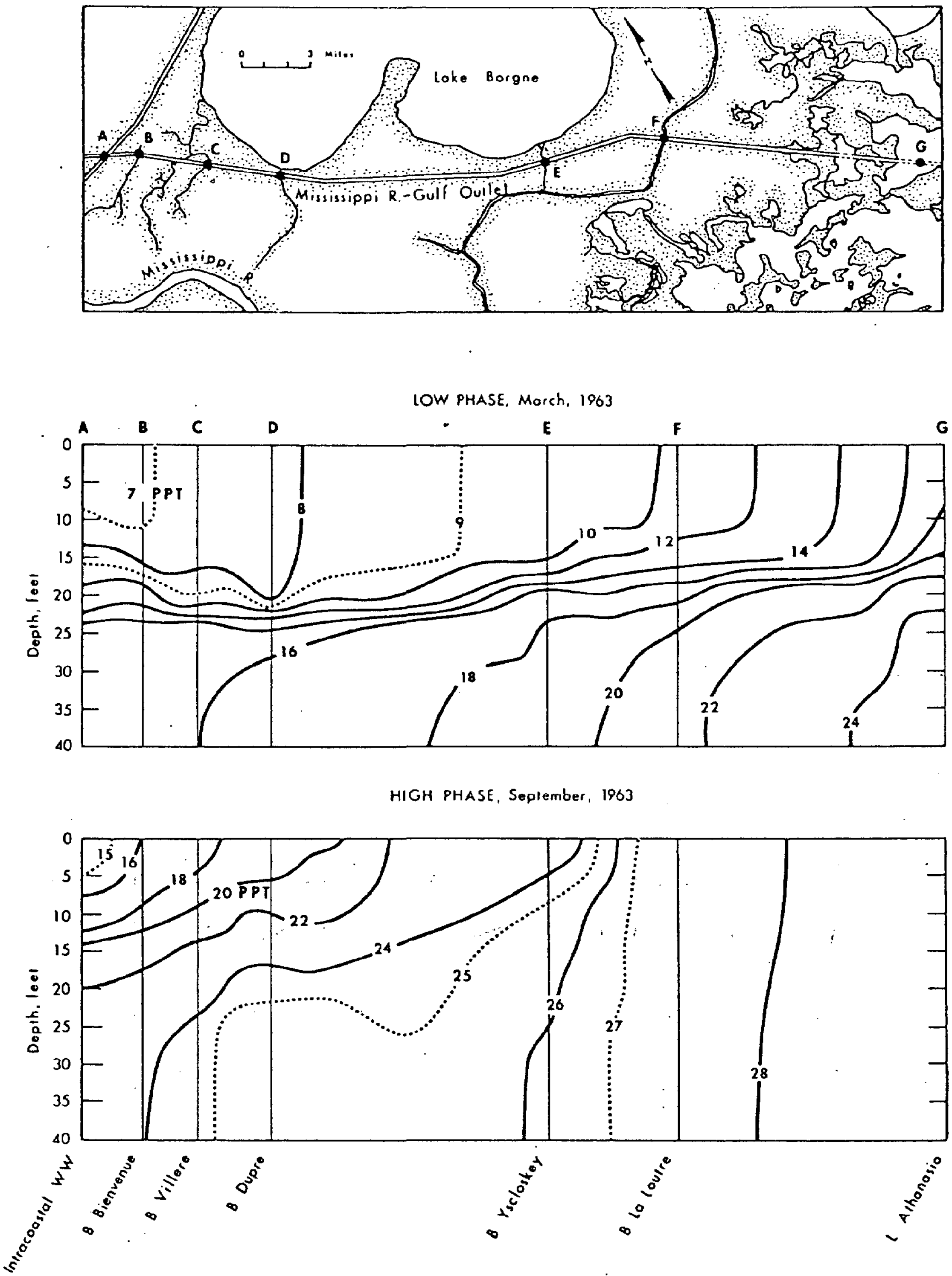

Figure D-3. Vertical salinity structure in the MRGO. Note extreme salinities in the vicinity of Bayou Bienvenue during September, 1963, a period of low fresh water runoff (After Amstutz, 1964).

Table D - 3. Average Monthly Count of Total Coliforms per 100/ml - Mississippi River at Violet, 1973-1978.

Month	Average
January	8,400
February	6,000
March	6,200
April	13,500
May	7,900
June	19,500
July	12,400
August	35,100
September	26,300
October	28,300
November	17,100
December	8,700

Source: U.S. Geological Survey, 1973-1978

Table D-4. Organic Pollution Data for St. Bernard Parish Wetlands.

Station	Date	Fecal Coliform/100 ml	Total Coliform/100 ml
1	10-24-78	240	-
2	10-24-78	79	-
3	10-24-78	46	-
4	10-24-78	33	-
5	10-24-78	13	-
6	10-24-78	13	-
7	10-24-78	2	-
8	10-24-78	<2	-
9	1-28-76	1100	>1100
9	1-17-76	23	75
9	5-26-76	43	93
9	8-11-76	13	47
9	2-02-77	33	920
9	4-11-77	130	350
10	1-28-76	43	43
10	1-17-76	9.1	23
10	5-26-76	43	75
10	2-02-77	7.8	220
10	4-11-77	23	23
11	1-28-76	43	43
11	3-17-76	15	93
11	5-26-76	9.1	150
11	2-02-77	7.8	13
11	4-11-77	<1.8	2
12	1-28-76	23	
12	3-17-76	29	29
12	5-26-76	<3	9.1
12	8-11-76	2	2
12	2-02-77	2	2
12	4-11-77	<1.8	4.5

Source: Louisiana State Department of Health and Human Resources, unpublished data.

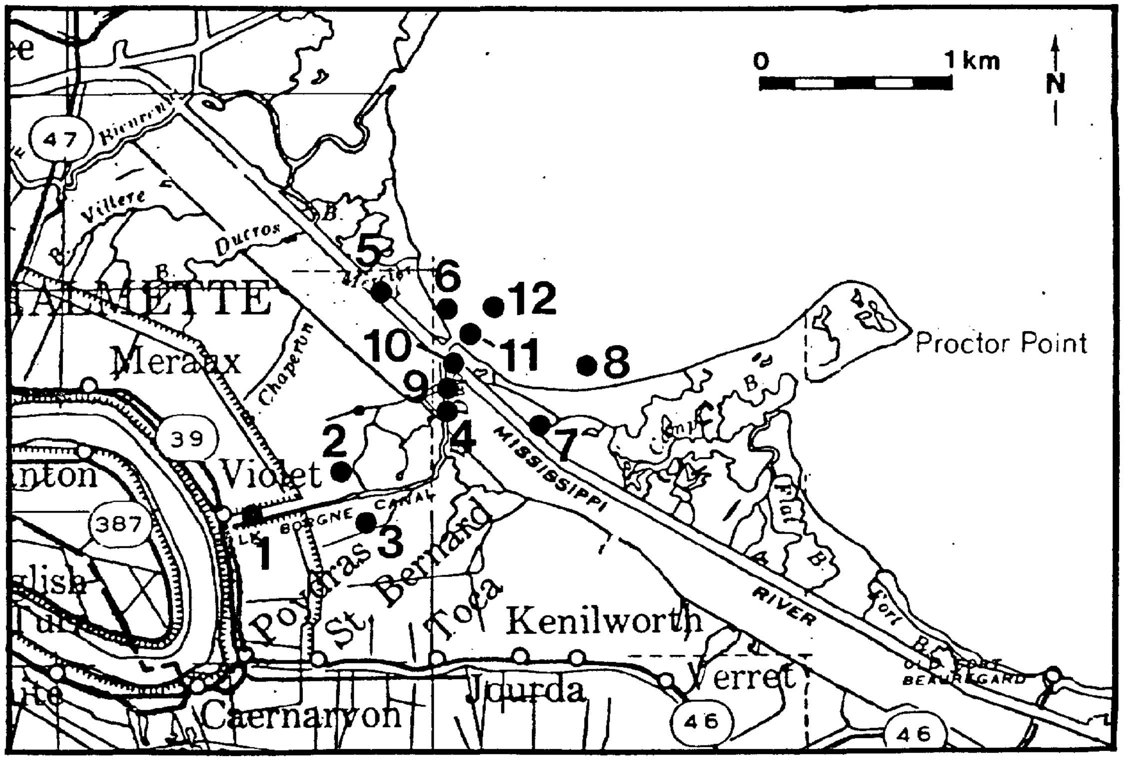

Figure D-4. Location of water quality sampling stations.

Heavy metals and pesticides are also pollutants present in varying quantities in St. Bernard Parish. Table D-5 compares heavy metal data for the Mississippi River at Violet with stations 9 and 10 shown in Figure D-4. Concentrations of pesticides in the Mississippi River at Algiers and in Bayou Dupre are shown in Tables D-6 and D-7. Pesticide levels are generally low in St. Bernard waters except for the concentration of Diazinon in Bayou Dupre.

C. ENVIRONMENTAL EFFECTS

Many of the structural measures of a wetland management program will alter water characteristics. Construction of structures in aquatic environments will increase turbidity, and the resuspension of organic sediments may cause lowering of dissolved oxygen levels. When structures are in place, permanent alteration of water characteristics can occur. Water control structures such as weirs, dams, and levees can alter water levels, salinities, circulation, turbidity, dissolved oxygen, and other water characteristics. The placement of these structures will be used to obtain anticipated desired effects, and these will be closely monitored.

The use of Mississippi River water to ameliorate the effects of saltwater intrusion can also lead to water quality problems. The introduction of river water into the wetlands will increase the possibility of rising coliform levels and heavy metal concentrations. The effects of these actions will also be closely monitored. Mississippi River water quality is expected to improve and to comply with Federal standards in the very near future.

Table D-5. Heavy Metal Data for Stations 9 and 10 on Bayou Dupre and the Mississippi River at Violet.

	(micrograms/liter)								
Station	Cn	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn
10	.00	0	0	0	1	0	.3	0	0
9	.00	1	0	0	3	0	.1	0	0

* stations 9 and 10 result from one sample date. The Mississippi River data are averages of 39 sample dates.

Source: Leone, 1976

Table D-6. Pesticide Levels in the Mississippi River at Algiers Lock Forebay (1975).

Date	Aldrin	Chlordane	DDD	DDE	DDT	Dieldrin	Endrin	Heptachlor Epoxide	Heptachlor	Lindane	Toxaphene	Diazinon	Parathon	Trithion	Ethion	Malathion	Methyl Parathion	Methyl Trithion	Silvex	2,4-D	2,4,5-T
March 17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
March 20	-	-	-	-	-	-	-	-	-	-	-	-	-	.00	.00	-	-	.00	-	-	-
June 11	.0	.0	.00	.00	.00	.00	.00	.00	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
June 18	.0	.0	.00	.00	.00	.00	.00	.00	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Source: Demas, 1976

Table D-7. Pesticide Data for Stations #9 and #10 on Bayou Dupre (Date: January, 1976). (Micrograms/liter)

Station	Aldrin	Chlordane	BDD	DDE	DDT	Dieldrin	Endrin	Heptachlor Epoxide	Heptachlor	Lindane	Toxaphene	Diazinon	Ethyl Parathion	Ethyl Trithion	Ethion	Malathion	Methyl Parathion	Methyl Trithion	Silvex	2,4-D	2,4,5-T
#10	.0	.0	.00	.00	.00	.00	.00	.00	.00	.00	0	.02	.00	.00	.00	.00	.00	.00	.00	.01	.00
# 9	.0	.0	.00	.00	.00	.00	.00	.00	.00	.00	0	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00

Source: Leone, 1976

D. WATER QUALITY CHANGES

The development of wetland management programs is generally aimed at the manipulation of water characteristics. Most structural measures used in such programs will have a beneficial effect on water quality or will stabilize rapid fluctuations of water parameters.

In some situations a trade-off is necessitated in the manipulation of water parameters. The use of Mississippi River water to counteract the effects of saltwater intrusion is only at the expense of the possible introduction of organic waste, heavy metals, and other pollutants into some wetland areas. Although wetland vegetation has the ability to filter out water pollutants (Odum, 1970), the use of river water in wetland management will require a monitoring of pollutant levels in water and sediment. In some cases the pollution levels may necessitate a temporary change in the suitability of water for particular uses.

SECTION E: WASTE WATER TREATMENT PLANTS

A. PRESENT FACILITIES

At present, St. Bernard Parish has three sewage treatment plants and two oxidation ponds. A fourth treatment plant is presently under construction at Violet. The locations of the plants and ponds are shown in Figure E-1. All of the sewage treatment plants in the parish are secondary treatment plants. In all cases, solid wastes from the facilities are disposed of in the parish dump on Paris Road. The liquid effluent from the Dravo and Munster Plants is discharged into the 40 Arpent Canal. The effluents from the Fazenlville plant are discharged into the Mississippi River. The Violet plant, when completed, will also discharge effluent into the Mississippi River.

B. FUTURE OR PROPOSED FACILITIES

The only plan the parish has concerning waste water treatment plants is an expansion of the capacity of the Munster sewage treatment plant.

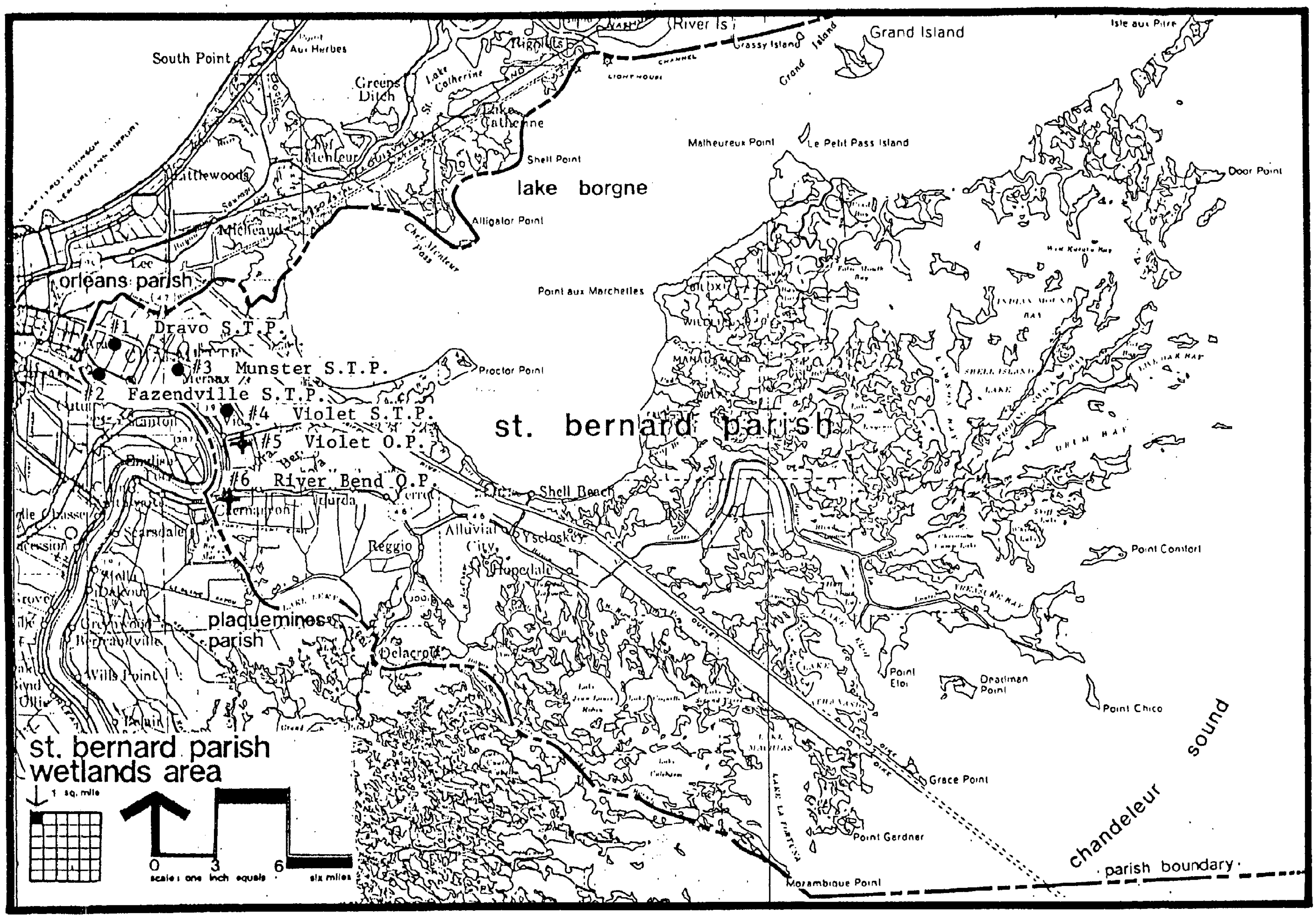

Figure E-1. Sewage treatment plants (S.T.P.) and oxidation ponds (O.P.), St. Bernard Parish, Louisiana.

SECTION F: SOILD WASTE MANAGEMENT

A. PRESENT FACILITIES

At present, the solid waste of St. Bernard Parish is disposed of at the Parish disposal site on the west side off Paris Road just north of the 40 Arpent Canal.

B. FUTURE OR PROPOSED FACILITIES

At present, St. Bernard Parish has no definite plans for future solid waste disposal. The parish is currently participating in a Metropolitan solid waste disposal study with other parishes' local governments. The study will assist the Parish in the development of plans for future solid waste disposal.

SECTION G: HUMAN POPULATION

A. DESCRIPTION

St. Bernard Parish had a total population of 61,966 in 1976 (St. Bernard Parish Planning Commission Census data, 1977). In 1975, the population was 57,549, representing an increase of 5% over the previous year (Louisiana State Planning Office, 1976). The majority of the parish population is concentrated in a linear development corridor along the levee areas of the Mississippi River, Bayou La Loutre, and Bayou Terre-Aux-Boeufs where the highest and most suitable land for residential development is encountered. Population increases during the period 1970 to 1974 are shown in Table G-1. This table shows that the increasing rate of growth for St. Bernard Parish during the four year period from 1970 to 1974 is 9.1% greater than the percentage rate of growth shown by the State of Louisiana as a whole. Since the 1950s, the Parish has been changing from an agricultural and rural character to a more urban character. The outdoor recreation opportunities offered make it an attractive place to live. Projected population for the year 1985 is 101,947 (Burford and Murzyn, 1972).

Table G-1. Population Growth for St. Bernard Parish and the State of Louisiana from the year 1970 to 1974

	1970	1974	% Change
St. Bernard Parish	51,185	57,549	12.4%
Louisiana	3,643,180	3,762,309	3.3%

Source: Louisiana State Planning Office, 1976.

B. ECONOMY

1. Agriculture

The first settlers in the area were Europeans, mainly French, who engaged in agriculture and trade. Many Spainards from the Canary Islands settled in St. Bernard Parish during the Spanish domination of the New Orleans area, approximately during the last 30 years of the 18th century. They were mainly farmers who cultivated sugarcane quite successfully. Acadians, who also settled in the parish after they abandoned Canada because of British domination in around the 1750s, were also successful farmers, planters, and trappers. St. Bernard's plantation type of economy slowly started to change after the Civil War and small farms and truck farms developed. During the lumber period in the late 1800s and early 1900s, almost all of the virgin cypress forest swamps were cut to provide for the demand for construction material, primarily in the New Orleans area.

Since the 1950s, the parish natural levee lands have been rapidly changing from a rural character to an urban and industrial character. Many agricultural lands have been claimed by urban and industrial expansion.

2. Industry

In the last few decades the Parish industrial economy has been primarily centered around manufacturing. Twenty one and one-half percent of its labor force was engaged in this activity in 1970; construction, public administration, wholesale trade, retail trade, and transportation followed in order of importance. Major manufacturing and processing industries found in the parish are shown in Table G-2.

3. Miscellaneous

The principal resources in St. Bernard Parish are minerals, fish and shellfish, and furs. The value of production for minerals in 1971 was $50,692,000. Figures for a fisheries total are not available for St. Bernard Parish exclusively, but the total harvested nursery area production for the Lake Pontchartrain - Borgne Basin and the Lery - Breton Basin was $11,500,000 in 1972 (USCE, 1975b). Furs have experienced a decline in recent years because of environmental changes in this area, such as lack of fresh water influx into the wetlands, and recreation, especially water oriented activities.

C. INSTITUTIONS

1. Educational Institutions

The total number of schools in St. Bernard Parish, as well as other selected statistics in regard to education, are shown in Table G-3.

Table G-3. Selected Educational Statistics, St. Bernard Parish, La.

*Total Schools	23
Number of Non-Public Schools (1974-1975)	6
Number of Public Schools (1974-1975)	17
Total Registration (1974-1975)	13,605
Faculty/Student Ratio, Public Schools (1974-1975)	1:20.7
**Median Years of School Completed by Persons 25 yrs and Older, 1970	12.1%
College Graduates, Persons 25 years or over, 1970	10.7%

* Louisiana State Department of Education, 1975
**Public Affairs Research Council, 1973

Table G - 2. Major Manufacturing and Processing Industries - St. Bernard Parish

Company Name	Product/Commodity Description
American Sugar Co.	refined cane sugar, liquid sugar.
Kaiser Aluminum and Chemical Corporation	Cryolite, calcined petroleum coke, aluminum ingots, billets, and re-draw rods.
Tenneco Oil Company	gasoline, diesel fuel, propane, benzene, toluene, ethylbenzene, zylenes, orthoxylene, petroleum coke.
Murphy Oil Company	refined petroleum products.
Jackup Boat Builders, Inc.	custom pressbrake and shearing, hydraulic cranes.
Gulf Soap Corporation	meat and bone meal, poultry meal, yellow grease.
Alback Co., Inc.	pressure vessels, tanks, stacks.
Bergeron Machine Shop	steel fabrication, marine, industrial, and oil field repair.

Source: U. S. Department of the Army, 1975

2. Health

Data pertinent to health in St. Bernard Parish is presented in Table G-4.

Table G-4. Composite Health Status Indicator, St. Bernard Parish, La.

Number of non-Federal physicians per 1,000 population	15	(Dec. 1, 1973)
Number of hospitals	1	(Dec. 1, 1973)
Infant death rate per 1,000 live births (-)	26	
Morbidity rate per 1,000 (+) population	803	
Number of deaths per 1,000 caused by cancer (-)	53	
Number of deaths per 1,000 caused by heart disease (-)	101	

Source: Department of Health and Human Resources, 1978
Center for Health Services Research and Development, 1974

There are several medical facilities and health care units within the parish. The proximity to the city of New Orleans makes the hospitals and other outstanding medical facilities available to the inhabitants of St. Bernard Parish.

3. Electrical Service

St. Bernard Parish is located within the electrical service area of the Louisiana Power and Light Company.

4. Telephone Service

St. Bernard Parish is served by the South Central Bell Telephone Company.

D. DISRUPTION OF SERVICES

Since the majority of the structural measures are to be constructed in the wetland areas, disruption of services in urban and semi-urban areas is improbable.

E. RELOCATION

No displacement of people or major facilities is foreseen as a consequence of the proposed wetland management program.

SECTION H: TRANSPORTATION

A. HIGHWAYS

Most of the major highways and roads in St. Bernard Parish are located on the higher grounds along the natural levees. Highway 47 (Paris Road), which serves as a major access-egress artery into and out of the parish, is planned to be converted into an interstate spur route (I-510) in the near future. Highways 39, 46, and 300 serve and connect all the urban and semi-urban areas of the parish along the Bayou La Loutre and Bayou Terre-Aux-Boeufs ridges.

B. RAILROADS

Railroad lines and terminals serve the main industrial area of the parish along its 16 km (10 mi) route of the Mississippi River front.

C. WATERWAYS

There are numerous natural waterways in the parish which are navigable, and many other man-made waterways traverse the area. The most significant man-made waterway is the MRGO, built in the late 1950s.

D. PIPELINES

Many pipeline canals serving as transportation channels for the oil and gas industry cross the parish, as do canals dug for the purpose of exploration by this industry.

E. AIR TRANSPORTATION

New Orleans International and Lakefront Airports are in proximity to St. Bernard Parish. At present, both airports satisfy the needs of the parish for air transportation facilities. Transporatation systems of the parish are shown in Figure H-1.

F. IMPACTS ON TRANSPORTATION

The proposed action is not expected to have a significant adverse impact on either terrestrial or aquatic transportation routes. However, temporary inconveniences might be expected during construction and implementation of some of the envisioned structural measures.

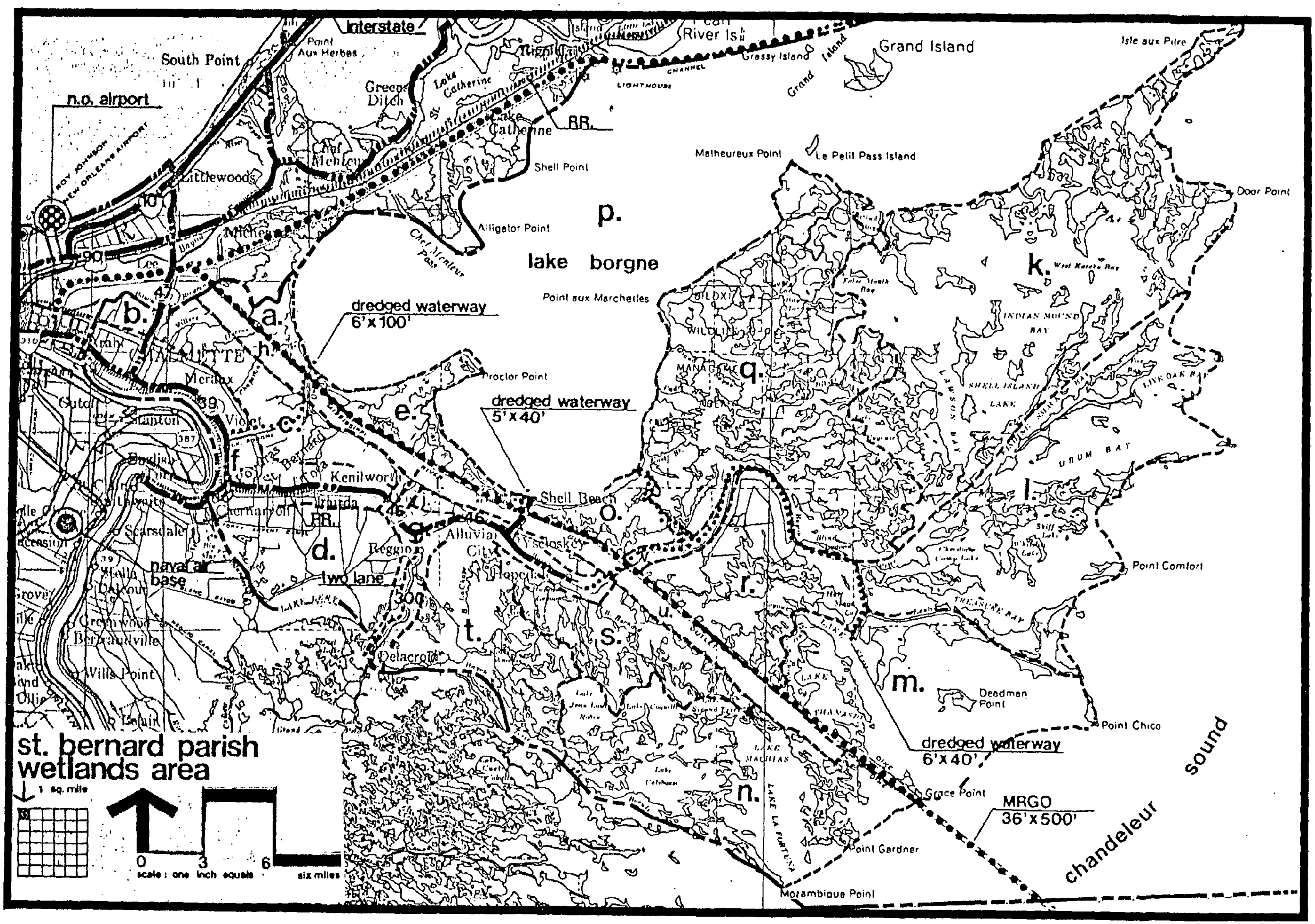

Figure H-1. Existing major transportation routes, St. Bernard Parish, Louisiana.

SECTION I: WILD AND SCENIC RIVERS

The following bayous and segments of bayous within the study area are scenic rivers:

Bayou Dupre - from the Lake Borgne Canal to Terre Beau Bayou
Lake Borgne Canal - from the Forty Arpent Canal to Bayou Dupre
Bashman Bayou - from its origin to Bayou Dupre
Terre Beau Bayou - from Bayou Dupre to the New Canal
Píroque Bayou - from Bayou Dupre to New Canal
Bayou Bienvenue - from Bayou Villere to Lake Borgne
Bayou Chaperon - from its origin to its end

The proposed wetland management program will eventually improve the quality of such bayous. In the event that any structural measures will temporarily affect any of these streams, the necessary and required permits will be obtained from the Department of Wildlife and Fisheries which administers the Louisiana Wild and Scenic Rivers system.

SECTION J: HISTORIC PRESERVATION

A. NATIONAL REGISTER OF HISTORIC PLACES IN ST. BERNARD PARISH

Three sites are currently listed on the National Register of Historic Places: Chalmette National Historical Park, Fort Proctor (admitted September 20, 1978), and Magnolia Mound Archeological Site (admitted May 22, 1978). The first two are significant in the history of the area, the last is a large and important prehistoric site. The Chalmette Battlefield includes most of the area where Americans under Andrew Jackson repelled the British during the Battle of New Orleans on January 8, 1815. Fort Proctor (16 SB 83) was built beginning in 1856 to defend the City of New Orleans from attack via Lake Borgne, and represents a masterpiece of military construction of the time period. Magnolia Mound (16 SB 49), an extensive complex of clam middens, conical mounds of the Marksville period (0 to 400 A.D.) surrounding a plaza, and pyramidal mounds of the Mississippi period (1,000 to 1,700 A.D.), may have had a central function in the settlement system of the two periods.

A number of other prehistoric and historic sites and landmarks in St. Bernard Parish are potentially eligible for nomination to the National Register of Historic Places.

B. ARCHEOLOGICAL AND HISTORICAL RESOURCES

St. Bernard Parish has a rich history and cultural setting. Since prehistoric times, man has found this area to be a very desirable environment in which to live. Archeological records show that the St. Bernard delta complex was occupied by man as far back as 1,740 B.C. Evidence of man during prehistoric and early historic times can be found in many Indian mounds and middens in the area. These sites represent cultures from the Poverty Point Period (1,800 to 500 B.C.), through Tchefuncte and Marksville periods (500 B.C. to 300 A.D.), the Troyville and Coles Creek periods (300 to 1,000 A.D.), to the Mississippi period and early historic times (1,000 to 1,700 A.D.). They provide a valuable record of the development of culture in the area, how man coped with environmental conditions, used natural resources, and structured his society.

C. GENERAL ARCHEOLOGY

Although there are about 90 identified prehistoric archeological sites in St. Bernard Parish, a complete archeological survey of the parish would probably uncover many more. A detailed study of new sites might reveal even earlier Indian occupations than the cultural periods that have been recorded and established from potsherds and artifacts recovered on the known sites. The lower levels of some of the known sites may also yield evidence of earlier Indians.

D. TYPES OF SITES AND LOCATION

The archeological sites fall into four different classes: earth mounds, shell mounds, shell middens, and beach deposits. Earth mounds are quite distinguishable features in the parish landscape. Elevated from the surrounding flat topography, they were built by the Indians apparently as burial tumuli or temple foundations. The Magnolia Mound complex near the Great Bend of Bayou La Loutre is a fine example of a group of earth mounds. Shell mounds and middens are sites which were occupied by Indians. They usually are either low-lying shell accumulations without a preconceived shape or ridge-like in form, sometimes .9 to 2.4 m (3 to 8 ft) high and up to a hundred meters in length. Beach deposits are wave-washed accumulations of sherds and shell, representing the remains of a naturally destroyed site. Recorded Indian sites in St. Bernard Parish are depicted in Figure J-1.

E. STATUS

The principal threats to archeological resources in St. Bernard Parish are 1) subsidence below the level of the marsh, which prevents surface detection of the site, and thus its availability for study; 2) dredging during pipeline and other canal construction; 3) wave erosion, which may be exacerbated by boat traffic; and 4) vandalism (pot hunting).

Prehistoric Indian sites in St. Bernard Parish can be described as being in one of several conditions:

1) Completely undisturbed (not damaged, not partially subsided)
2) In disrepair (refers to historic buildings and structures)
3) Partially subsided
4) Completely subsided
5) Dredged (totally destroyed or eroding at exposed cutbank)
6) Partially wave-washed (part of the site has been eroded and is being redeposited on a beach)
7) Completely wave-washed (all of the site has been eroded away and has been redeposited on a beach)
8) Completely destroyed (no remaining evidence of the site)

No sites in the parish are completely undisturbed. Table J-1 shows the change in condition which has occurred over the last 20 to 40 years to 34 of the parish's sites (not a complete list of parish sites). It can be seen from the table that 15 sites (44%) originally

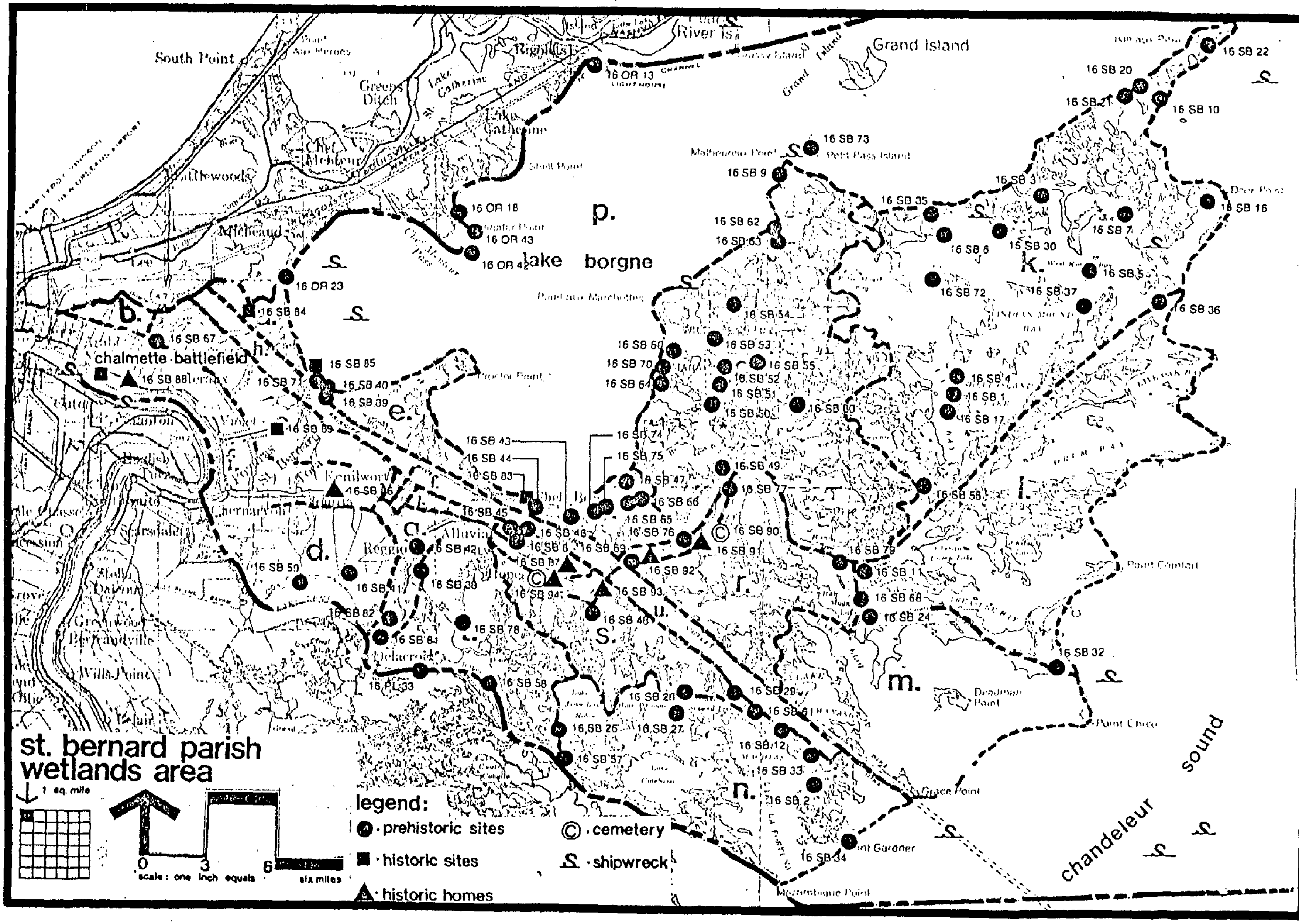

Figure J-1. Archeological and historical sites, St. Bernard Parish, Louisiana.

Table J-1. Change in Condition of St. Bernard Parish Archeological Sites Since Initial Recording.

Site No.	Initially Recorded	Revisited	Change in Condition
16 SB 1	1935	1976	No change. (Already wave-washed).
16 SB 2	1935	1976	Partially wave-washed to completely wave-washed
16 SB 4	1935	1976	No change (already wave-washed)
16 SB 6	1935	1976	Completely wave-washed to completely destroyed
16 SB 9	1935	1976	Partially wave-washed to completely wave-washed
16 SB 11	1935	1976	Partially wave-washed to dredged
16 SB 12	1935	1978	Partially wave-washed to dredged
16 SB 17	?	1976	Completely wave-washed to completely destroyed
16 SB 24	1952	1976	Partially wave-washed to dredged
16 SB 27	1935	1976	Partially wave-washed to completely destroyed
16 SB 28	1935	1976	No changes (dredged and eroding)
16 SB 29	1935	1978	No change (partially subsided)
16 SB 30	1935	1976	Partially wave-washed to completely destroyed
16 SB 33	1952	1976	No change (partially subsided)
16 SB 35	1952	1976	No change (partially subsided)
16 SB 39	1952	1978	No change (partially dredged)
16 SB 40	1952	1978	Partially wave-washed to dredged
16 SB 43	1952	1978	No change (partially dredged)
16 SB 44	1935	1978	No change (completely wave-washed)
16 SB 45	1952	1978	No change (dredged and eroding)
16 SB 47	1935	1976	No change (partially wave-washed)
16 SB 49	1935	1976	No change (partially subsided)

Table J-1. Change in Condition of St. Bernard Parish Archeological Sites Since Initial Recording (Continued).

Site No.	Initially Recorded	Revisited	Change in Condition
16 SB 50	1952	1976	No change (partially subsided)
16 SB 51	1952	1976	No change (partially subsided)
16 SB 52	?	1976	No change (partially subsided)
16 SB 53	1952	1976	No change (partially subsided)
16 SB 55	1952	1976	Partially wave-washed to dredged
16 SB 56	1952	1976	No change (partially subsided)
16 SB 57	1953	1976	Partially wave-washed to dredged
16 SB 58	1953	1976	Partially wave-washed to dredged
16 SB 60	1953	1976	Partially wave-washed to completely wave-washed
16 SB 61	1953	1976	Partially wave-washed to completely destroyed
16 SB 62	1953	1976	Partially wave-washed to completely wave-washed
16 SB 64	1953	1976	Partially wave-washed to completely wave-washed

recorded as only partially wave-washed have since become completely wave-washed, dredged, or completely destroyed. Nine sites originally recorded as intact but partially subsided remained in this condition until 1978. These intact sites offer the greatest potential for future research.

F. GENERAL HISTORIC INFORMATION

Europeans settled in the New Orleans area around 1700, and by the late 1800s the population had reached about 120,000. On March 31, 1807, the parish of St. Bernard was created. Periods of French, Spanish, British, and American dominance are well recorded by historic sites in the area. The contributions of various cultural mixtures and ethnic groups that give the area its character are still apparent in monuments, buildings, folklore, and historic places.

The French were the first settlers of the parish lands. Many of these became famous men of their time as governors of Louisiana, explorers, soldiers, and plantation owners, thus leaving their names recorded in history. These names, such as Feret, Bienvenue, De Laronde, and Chalmette, are now associated with the St. Bernard area. Most settlers were farmers, and their major crop was indigo until cotton was introduced in 1740.

In 1762, Spain took control of Louisiana until 1803. Many Spaniards from the Canary Islands settled in the parish. Two of these Spaniards, Mendez and Solis, were quite successful in cultivating sugarcane, and tried to find a method for its crystallization.

Acadians also settled in the parish. Some came directly from Canada, others came from the island of Santo Domingo in the Caribbean Sea.

They were farmers, planters, and excellent trappers; and their influence is evident in the food and folklore of the area.

On December 23, 1803, the territory of Louisiana was officially transferred to the United States. On December 14, 1814, the famous Battle of New Orleans where Andrew Jackson defeated the British forces, took place almost entirely in St. Bernard Parish. Near the battlefield is the "Four Oaks" commemorative site where it is said that the British General, Pakenham, died.

Many areas of the parish contain a number of sites commemorated by historical markers, including the St. Bernard Church and Cemetery; the sites of the former De La Ronde, Villere, and Contreras Plantations; and the Ducros Historical Museum. Future markers are planned to recognize the former sites of the Jumonville and Reggio Plantations. The Kenilworth Plantation, a private residence, was built in 1759 and is in excellent condition as of 1976.

The U.S. National Cemetery near Chalmette was established in 1864. More than 14,000 soildiers and sailors from every part of the U.S. are interred here, although about half of the graves are unidentified. Two graves are those of men that died in the Battle of New Orleans. The cemetery is listed in the National Register of Historic Places. Historically significant sites are identified in Figure J-1.

After the Civil War (1861-1865), the plantation type of economy of St. Bernard Parish slowly started to transform into small farms, mainly truck farms. This was also the great lumbering period when nearly all the virgin cypress forest swamps were cut. Fishing and trapping became significant in the parish economy.

The history of man's technological development in relation to the natural resources of the area is also well represented in the parish. The site of the first steam sugar mill in the parish can still be visited. New plants and industrial facilities show the latest technological advancements in oil, gas, and manufacturing industries.

Since the 1920s, St. Bernard Parish has been gradually changing from its previous agricultural and rural character. The excellent water-oriented recreational opportunities offered by the parish and its proximity to New Orleans have made it an ideal place to live. Since the 1950s, the most suitable areas for urbanization have experienced a great amount of development. Today, the wetland areas of the parish, with their valuable natural resources and attractions, are in danger of being lost to the needs and demands of urbanization and industrialization as well as to natural forces.

G. EVALUATION OF SITES

This section will deal specifically with the evaluation of archeological sites, both for their scientific and viewing potential. In most cases, these two forms of site evaluation go hand in hand. If a site is proven to be of good scientific value, more than likely it will also have the appearance, accessibility, and uniqueness that will allow it to serve as an informative tourist or recreational attraction.

To facilitate our discussion, the parish will be divided into sectors (Figure J-2). Sites within each sector will be discussed as a unit and compared according to importance. All of the sectors have

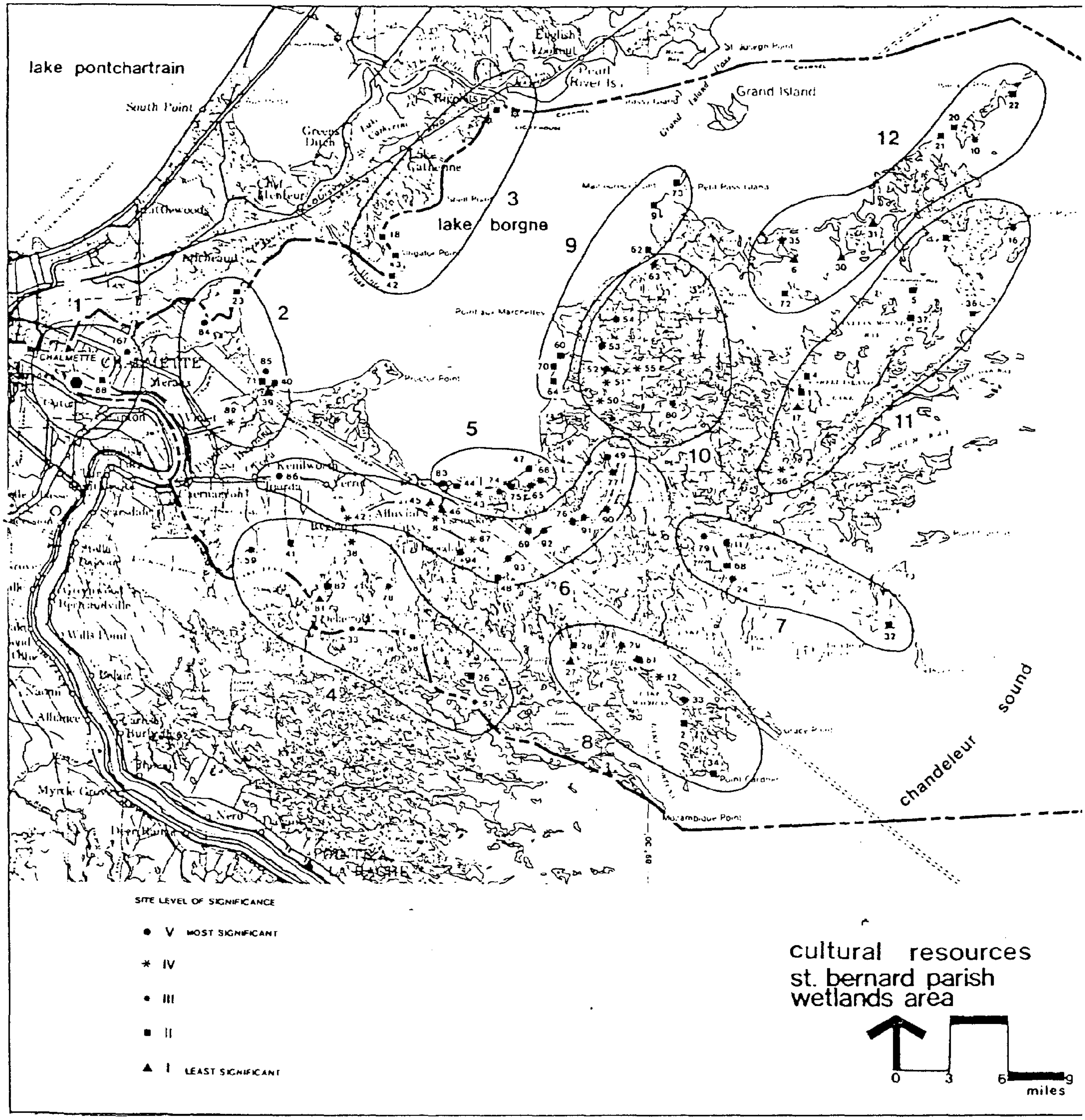

Figure J-2. Archeological sites in St. Bernard Parish, grouped according to sectors and indicated by levels of significance.

been compared to each other based on a point score. The point score was derived by summing point scores assigned to each site in the sector based on the site's ranked significance (1 to 5).

1. Sector 1 (5 points)

This sector is confined to the area in and around the present town of Chalmette. Two historic sites, Chalmette Battlefield and De La Ronde Plantation (16 SB 88), are located within the city limits. The battlefield is already in the National Register of Historic Places, while the plantation is a well-known historic locale along St. Bernard Highway. It is questionable as to what information can be gained from the plantation, as it is currently in almost total ruin and surrounded by road pavement. The prehistoric site (16 SB 67) is a late prehistoric locale of moderate surface expression, and may be worth investigating with one or two limited test pits.

2. Sector 2 (23 points)

This group consists of two prehistoric sites, three historic sites and two sites with a combination of both prehistoric and historic components. The sites with prehistoric components are significant for the location along a relict channel, but are in poor condition.

The three historic sites, Martello Castle (16 SB 85) (see Figure J-1), Battery Bienvenue (16 SB 84)(see Figure J-2), and Lake Borgne Canal Redoubt (16 SB 89), are nineteenth century American gun emplacements. They were strategically positioned at the mouth of Bayou Dupre, a bend in Bayou Bienvenue, and along the Lake Borgne Canal to allow control of these waterways and to block their use as back door approaches to New

Orleans. Both would offer valuable information on small, nineteenth century gun emplacements and the lifestyles of those who manned them. Restoration as possible tourist attractions is not inconceivable for any of the sites.

3. Sector 3 (8 points)

The four sites in this sector are all listed as Orleans Parish sites. However, since the border of St. Bernard Parish is the shoreline around Lake Borgne, the drowned portions of these sites lying below the lake's surface are technically in St. Bernard Parish. None of the four offer much in the way of salvage or recreational possibilities. They are all completely wave-washed and are not of much use for stratigraphic testing or sight-seeing.

4. Sector 4 (30 points)

This is the first major site cluster with which we will deal. Sites in this sector are associated with distributaries of the ancient Bayou La Loutre course of the Mississippi River. Bayou Terre-Aux-Boeufs is the major distributary in this case, but others, now submerged beyond recognition, also play a role.

Of these Sector 4 sites, the most promising is probably Reggio IV (16 SB 38). A village area is almost certainly associated with the mound, and test excavations would probably prove valuable. The other sites are all either subsided, dredged, or are eroding rapidly along Bayou Terre-Aux-Boeuf's banks. Sites 16 SB 58 and 16 PL 33 were at one time highly impressive middens, stretching along both banks of Bayou Terre-Aux-Boeufs for over 2.4 km (1.4 mi) each. When the area was visited in June 1976, only a few scattered Rangia lenses were found exposed in the banks. It is probable that this reflects conditions of high water, the unfavorable situation occurring during the survey. More importantly, however, the erosional action along the bayou has taken a heavy toll, and great portions of the sites have been annihilated. If this erosion can be halted for the sites along Bayou Terre-Aux-Boeufs, then some scientific investigations should be possible. The sites, if properly preserved, would be definite points of interest for educational and recreational boat tours, as they are mostly situated along an easily travelled waterway, namely Bayou Terre-Aux-Boeufs.

5. Sector 5 (29 points)

A cluster of wave-washed Rangia middens along Lake Borgne, shell mounds and middens on relict beach ridges, nineteenth century homes, and a nineteenth century fort form the archeological sites of this sector. The wave-washed sites are represented by a portion of Bayou St. Malo (16 SB 47) and Shell Beach (16 SB 44). Shell Beach, although wave-washed and situated along a rapidly retreating shoreline, is significant for a number of reasons. It is the only site thus far recorded in St. Bernard Parish at which artifacts of the Tchula period (500 B.C. to 1 A.D.) have been found. Aside from that occupation, Shell Beach was also inhabited during prehistoric times by Indians of later periods. During historic times, the site also served as a living area for officers and men stationed at Fort Proctor (16 SB 83), and as a favored resort community with a beach front hotel and summer homes. These houses and the hotel have been obliterated in the last one hundred years, however, so that the only evidence of their previous presence is scattered bottles, coins, utensils, etc., strewn along the lake shore. In places back from the shore and along Bayou Yscloskey, in situ remains may be expected, although none have yet been reported. Four other prehistoric sites, Dolluts Canal (16 SB 43), Bayou St. Malo (16 SB 47), Orange Mound (16 SB 74), and Northwest of Bayou Guyago (16 SB 75), are situated atop old beach ridges or "cheniers."

Finally, perhaps one of the most important historic sites in the parish, Fort Proctor (16 SB 83), also known as Fort Beauregard, is located in this sector. Much like Battery Bienvenue and Martello Castle, Fort Proctor was constructed in the middle of the nineteenth century as a key station in the defense of New Orleans. Its strategic location enabled it to guard the entrance to Bayou Yscloskey. When originally constructed, the fort was about 60 or more meters (196 or more miles) south of the Lake Borgne shore. However, at present the fort is being affected by wave action and subsidence. The northern wall of the fort has succumbed to the advancing waters, and if nothing is done shortly, the remainder of the structure will collapse as well.

6. Sector 6 (50 points)

It is within this sector that we find the most plentiful array of archeological sites. It is also within this sector that we see the most historic sites and the largest, potentially most important prehistoric site in the parish.

We will begin our discussion of this sector with the historic sites. Perhaps the most important of these are Kenilworth Plantation (16 SB 86) and Proctor Sugar Mill (16 SB 87). As sightseeing locations, the two are ideally situated, being along the St. Bernard - Hopedale Road. Permission from the owners and access and parking facilities would necessarily pre-requisite any plans for their development as tourist attractions. The sugar mill, although currently in ruins, could be repaired to a representable degree and historic archeological investigations around the mill's grounds should add worthwhile data on possibly the first steam-powered mill in St. Bernard Parish. Kenilworth is an excellent example of a nineteenth century plantation, and is in such a fine state of preservation that hardly anything at all need be done in the line of restoration. The major consideration in this case is that the house is currently occupied and the owners may prefer privacy.

The other historic locales along Bayou La Loutre are all situated on the south bank of the bayou or north of the MRGO. In the late 1700s and early nineteenth century, the main avenue of traffic along Bayou La Loutre, besides the water itself, was a cinder-paved carriage and horse road located along the southern natural levee crest. This road appears to have run from Yscloskey to almost the Big Bend of Bayou La Loutre, with portions of it still visible today.

The relatively firm ground of the Mississippi and Bayou La Loutre's natural levees also offered the prehistoric inhabitants of this sector an ideal location for their camps, villages, and mounds. In the western portion of this sector are three earth mounds, Yscloskey (16 SB 8), Reggio II (16 SB 42), Bayou Yscloskey II (16 SB 46); and two shell middens, Bayou Yscloskey I (16 SB 45) and East Bayou (16 SB 46).

North of the MRGO, we find two highly eroded sites, Bayou La Loutre - MRGO (16 SB 69) and Bayou La Loutre (16 SB 77). The first is almost totally destroyed, while the second is suffering greatly from the impact of boat's wakes. The Bayou La Loutre site is important for two reasons. First, it is extremely extensive, running along both sides of the bayou from near the Engineers Canal north to Stump Lagoon. Although hardly recognizable because of the scarcity of shell, the site has offered a wealth of unique artifacts. Second, this site may reveal scattered evidence of early settlers in the area.

Finally, we come to the most significant and valuable of all of the St. Bernard Parish sites. This is the outstanding array of earth mounds, shell mounds, and middens collectively known as the Magnolia Mound site (16 SB 49). This immense site is in dire need of archeological investigation; more so, perhaps, than any other site in the parish. Besides the data such an excavation would reveal concerning the archeological story, it is so important that the site has been nominated to the National Register of Historic Places. Without a doubt, if one is to study a site in St. Bernard Parish, this is that site.

7. Sector 7 (14 points)

This is the lower Bayou La Loutre cluster which may not be situated upon the ancient Mississippi natural levee, and for this reason has been disassociated with Sector 6. All the sites in this sector, except northeast of Joe Shiman Pass (16 SB 79), are either partially or completely wave-washed shell middens. The most significant of these is the Bayou Petre site (16 SB 11).

This sector seems to have moderate potential; some sites deserve scientific testing. Bayou Petre especially deserves testing since it is the "type-site" of a phase as yet only haphazardly defined. The sites may not offer much in the way of sightseeing or special attractions, however.

8. Sector 8 (19 points)

The site which would seemingly offer the best data is Mulatto Bayou (16 SB 12). Its well-preserved, organic material makes it extremely attractive for future excavations.

Two other subsiding sites, for which not much is known but which are in a good state of preservation, are Lake of the Second Trees I (16 SB 29) and Seven Dollar Bay (16 SB 33). Test excavations into these two sites would probably be relatively simple and would offer a decent amount of data with which to work. The remainder of this sector's sites are all wave-washed, dredged, or totally destroyed, and would be useful only in the salvage of surface artifacts.

9. Sector 9 (12 points)

This is perhaps the least informative of all sectors. It is composed of sites which are all completely wave-washed shell middens. The sector was intentionally devised to include such sites.

10. Sector 10 (27 points)

The eight sites which form this sector constitute the best unaltered family of sites in the whole parish. Despite the fact that almost nothing is known of them, they potentially offer the greatest amount of information. Although it is not certain, they seem to be related to a now-submerged and ill-defined stream course which probably branched off of either the Bayou La Loutre - Mississippi channel or a stream similar to the present day Bayou La Loutre.

Three of these sites, Southwest of Cut-off Lagoon (16 SB 50), Northwest of Cut-off Lagoon (16 SB 51), and Bayou Biloxi II (16 SB 55), are composed of both earth mounds and shell middens. They are all in relatively excellent condition, although Bayou Biloxi II is suffering from an eroding bankline due to boat traffic on the bayou, and all are somewhat subsided. The remainder of the sites are all shell middens which, other than having subsided, are in fine shape.

This sector should undoubtedly employ a detailed excavation procedure that could unveil the heretofore undisclosed archeological record. The sites are also centrally located and fairly accessible in most instances, and could be featured as part of a boat tour through the Biloxi State Wildlife Management Area.

11. Sector 11 (20 points)

Sites in this sector are little known and represent a major data gap in the archeological record. Lake of the Mounds (16 SB 56) is reported to consist of two earthen mounds, one square and one circular.

No artifacts have ever been recovered from the latter site, but as we have seen, that is not uncommon. It would undoubtedly offer the best locale in this sector for limited test excavations.

12. Sector 12 (19 points)

This sector is again typical of the outer marsh environs of the parish, and the subsequent site alteration and subsidence common in such a locale. Perhaps the most informative sites in this sector will turn out to be Bayou Pierre (16 SB 10), a "shell mound" as reported on the site form; Johnson Bayou (16 SB 31), a "shell midden"; and Three Mile Bay (16 SB 35), a mound composed of both earth and shell. Aside from these, this sector lacks any valuable scientific potential. A couple of exploratory test pits into Bayou Pierre, Johnson Bayou, and Three Mile Bay should prove enlightening, however. The far-removed location of the sites reduces their possibilities as recreational locales.

13. Sector 13 (6 points)

This sector's sites are all highly reworked beach deposits on the Chandeleur Islands and the Freemason Islands. The islands themselves represent the last vestiges of the outer delta margin, since reworked and washed backward by the Gulf's waves. None of the islands of the Chandeleur arc are truly <u>in situ</u>, and thus neither are the two sites located on these transgressing beaches. The site on Neptune Point of the Freemason Islands (16 SB 19) may not be removed as much from its original location as the two on the Chandeleurs; but nevertheless, it is completely wave-washed.

The point scores show that Sector 6 (Central Bayou La Loutre area) is the most archeologically significant; Sector 1 is the least significant. This does not imply that Sector 1 cultural resources should be neglected. The area, in fact, includes several landmarks of historic interest. The point score merely shows that the potential for future archeological research is more limited here than in other parts of the parish.

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